Building Awareness and Supporting African Universities in ICT Management

The Big ICT Five
(Strategy, Development/Acquisition, Implementation, Utilization, Service Management)

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2003
PROPOSITIONS

belonging to the thesis
Building Awareness and Support
African Universities in ICT Management

by
Venâncio Simão Massingue

Delft University of Technology
21 October 2003

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STELLINGEN

behorende bij het proefschrift
Building Awareness and Support
African Universities in ICT Management

door
Venâncio Simão Massingue

Technische Universiteit Delft
21 oktober 2003
1. Lack of knowledge concerning the Big ICT Five is inspiring situations where numerous uncontrolled and soloist activities take place. (This thesis 11.1)

2. There must be no difference between the charges for ICT services delivered by the university computer centre to external organizations and those for services to internal units of the university. (This thesis 11.6.5.5)

3. Successful implementation of national ICT policies and ICT strategies in Africa needs education and research programmes in the Big ICT Five at the universities that are well defined and operational. (This thesis 11.5.1)

4. As the number of ICT projects in Africa increases, the skills of the internal workforce to implement all these projects become less and less sufficient. This calls for the development of strong skills internally, instead of a dominant external consultancy. (This thesis; chapter 1)

5. The relationship between the present African countries and the former colonial powers is still more easily detectable in the spoken official national languages than in the programming languages.

6. As a result of the application of ICT, the young generation has started to communicate through a new form of facilities, where the old generation stays behind.

7. A high and advanced production of paper, printers and photocopiers is a major prerequisite for today's electronic mail systems.

8. Because of the increasing investments of universities in ICT, the academic staff see their own traditional role being attacked.

9. Given that the power and decision-making processes are concentrated within the top management of the African universities, there is a need for a sound balance between the presence of the top management within the university and its external duties.

10. Africa has sufficient ICT starters (hors d'oeuvres), but lacks ICT main courses.

These propositions are considered defendable and as such have been approved by the supervisor, prof. dr. ir. M. Looijen.
1. Gebrek aan kennis van de 'Big ICT Five' inspireert situaties waarin talrijke ongecontroleerde en solistische activiteiten plaatsvinden. (Dit proefschrift 11.1)

2. Er dient geen verschil te zijn tussen wat in rekening wordt gebracht voor ICT diensten die het computer centrum van de universiteit verleent aan externe organisaties en wat in rekening wordt gebracht voor diensten aan interne eenheden van de universiteit. (Dit proefschrift 11.6.5.5)

3. Het succesvol implementeren van een nationaal ICT beleid en een nationale ICT strategie vereist duidelijk gedefinieerde en operationele programma’s voor onderwijs over en onderzoek naar de 'Big ICT Five' aan de universiteiten. (Dit proefschrift 11.5.1)

4. Met het toenemend aantal ICT projecten in Afrika neemt ook het gebrek aan eigen bekwaamheden om deze projecten te implementeren toe. Dit vraagt om een sterke opbouw van eigen bekwaamheden in plaats van een dominante externe advisering. (Dit proefschrift hoofdstuk 1)

5. De relaties tussen de huidige Afrikaanse landen en de vroegere koloniale machten is meer merkbaar in de officiële landstalen dan in de programmeertalen.

6. De toepassing van ICT zorgt ervoor dat de jonge generatie door middel van nieuwe faciliteiten communiceert, waarin de oudere generatie achterblijft.

7. Een hoge en geavanceerde productie van papier, printers en kopieerapparaten is een belangrijke voorwaarde voor de hedendaagse e-mail systemen.

8. Door de toenemende investeringen van universiteiten in ICT dreigen universitaire medewerkers steeds meer hun traditionele rol te verliezen.

9. Gegeven dat gezag en het nemen van beslissingen geconcentreerd is in het topmanagement van de universiteit is het noodzakelijk dat er een verantwoorde balans is tussen interne aanwezigheid van het topmanagement en haar externe verplichtingen.

10. Afrika heeft genoeg ICT-voorgerechten (hors-d’oeuvres), maar mist ICT-hoofdgerechten.

_Deze stellingen worden verdedigbaar geacht en zijn als zodanig goedgekeurd door de promotor, prof.dr.ir. M. Looijen_
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The Big ICT Five
(Strategy, Development/Acquisition, Implementation, Utilization, Service Management)

PROEFSCHRIFT

ter verkrijging van de graad van doctor
aan de Technische Universiteit Delft,
op gezag van de Rector Magnificus prof. dr. ir. J. T. Fokkema,
voorzitter van het College voor Promoties,
in het openbaar te verdedigen
21 oktober 2003 om 15:30 uur

door

Venâncio Simão MASSINGUE

degree of Licenciatura in electro-technical engineering
(University Eduardo Mondlane, Mozambique)

geboren te Chibuto district, Mozambique
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PREFACE

In many African countries Information and Communication Technologies (ICT) were widely used for the first time in the 1980s, brought in mainly through projects funded by foreign donors. Initially, ICT influenced education, business and industry. When the Internet became available in the 1990s, however, it rapidly penetrated other sectors, in all parts of Africa. During this period, the Southern Africa Development Community (SADC) undertook a large number of projects in the area of telecommunications. Throughout Africa, universities were overwhelmed by a great variety of ICT in their core areas of activity: education, research and administration.

The way in which ICT has been implemented in the universities has created problems and raised questions about the effectiveness and efficiency of ICT. Our reflection on these problems suggested that there was a need to investigate them further, and we therefore carried out initial assessments of the problems in several universities. Discussion of the problems with other universities led in turn to our organising a workshop in Maputo, Mozambique, with the top management of six universities in Southern Africa: the University of Botswana, the University of Dar-Es-Salaam (Tanzania), University Eduardo Mondlane (Mozambique), the University of Namibia, the University of Swaziland, and the University of Zambia.

This workshop gave formal status to the on-going research activities, and it was agreed that it would be useful to continue the assessments of the universities in relation to issues of strategy, development/ acquisition, implementation, utilization, and service management of ICT.

At the end of the assessments, it was concluded that we should elaborate a conceptual model of these issues, to build awareness in the universities and to support them in the implementation of ICT management. We also developed an automated tool, based on Internet technology, to help the universities to ‘navigate’ easily through all the information contained in the conceptual model.

I owe a great debt to my promotor Prof. dr. ir. Maarten Looijen, for leading me to all the knowledge I have gained and for helping me to navigate through the process of undertaking the research project and preparing the thesis document. He has given me his unfailing support and patience, despite my being a difficult student, and cheerfully tolerated our hectic and often inconvenient journeys. Together we have faced many good and many bad experiences during these past years, and through these have managed to build a true friendship.

I am very grateful to IDRC Canada, which provided essential funding for the research project.

I must thank H.E. Joaquim Chissano, President of the Republic of Mozambique, for his great encouragement, and H.E. Pascoal Mocumbi, Prime Minister of the Republic of Mozambique, for his constant support and interest in the project.

I would also like to thank Prof. Brazão Mazula, Rector of UEM, for his unfailing support and for allowing me time off from my other duties and functions in order to undertake the research project.

At the six universities, I give special thanks to Prof. Sharon Siverts, Vice-Chancellor, and Prof. Shabani Ndzingue, Deputy Vice-Chancellor of the University of Botswana; Prof. Mathew Luhanga, Vice Chancellor, and Prof Daniel Mkude, Deputy Vice Chancellor of UDSM; Prof. Peter H. Katjavivi, Vice-Chancellor of UNAM; Prof. Lydia Makhubu, Vice Chancellor, and Prof. Barnabas Dlamini, Acting Vice-Chancellor of UNISA; Prof. Mutale W. Chanda, Vice-Chancellor of UNZA, and, once again, Prof. Mazula at UEM. They all gave me their personal support, allowed me to undertake the assessments of their institutions and took a leading role throughout the investigation and validation. I must also express my appreciation to the Directors of the Computer Centres: Mr. Ratsela Mooketsi (UoB), Prof.
Beda M. Mutagahywa (UDSM), Prof. K.S. Suresh and Mr Clint Nicholson (UNAM), Mr. Thembela Thwala (UNISWA), Mr. John Musaka (UNZA) and Mr. Américo Muchanga (UEM) for their tremendous help in providing information, analysis and pertinent criticism.

I would also like to thank Jamo Macanze, Leonardo Xerinda, Isabel Matos, Onísio Soiane, Marielle Rowan and Kate Wild at CIUEM in Maputo for their valuable and continuous assistance during preparation of the thesis. For technical support in the realization of the system, I am most grateful to dr. João Dias, Luis Neves Cabral Domingos, António Morais and Zeferino Saugene. At TUDelft, my thanks are due to Dra. Mirjam J. Nieman for so thoroughly checking the English in the document.

On a personal level, I must thank Dr. Luisa Diogo, Prof. Dr. Orlando Quilambo, Prof. Dr. Manuel Araújo, Prof. Dr. Jamisse Taimo, Dr. Arlindo Sitoe, Dr. Julieta Duarte and Dr. Mafalda Mussengue, who gave me valuable moral support and encouragement to persevere in the face of adversity.

Charlotte not only tolerated patiently my frequent absences and preoccupations, but also tirelessly verified the ever-changing text and helped me to use the English language more effectively.

I must also express my gratitude to my daughters, Carlotta and Suzanna, as representatives of the extended Massingue family, for their constant support and understanding about my absences. Finally, I must thank my mother, Carlota Come, for bringing me into this world with all its challenges.

Venancio Massingue
March, 2003
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Exploring the Problem Area</td>
<td>1.1</td>
</tr>
<tr>
<td>1.1 Introduction</td>
<td>1</td>
</tr>
<tr>
<td>1.2 A brief overview of ICT in developed countries</td>
<td>3</td>
</tr>
<tr>
<td>1.2.1 The &quot;Information Era&quot;</td>
<td>3</td>
</tr>
<tr>
<td>1.2.2 Overview of the ICT industry in developed countries</td>
<td>3</td>
</tr>
<tr>
<td>1.2.2.1 ICT trade and suppliers</td>
<td>3</td>
</tr>
<tr>
<td>1.2.2.2 ICT and telecommunications products</td>
<td>4</td>
</tr>
<tr>
<td>1.2.2.3 Worldwide Conferences/Forums</td>
<td>4</td>
</tr>
<tr>
<td>1.2.2.4 Education</td>
<td>4</td>
</tr>
<tr>
<td>1.2.2.5 Publications</td>
<td>5</td>
</tr>
<tr>
<td>1.2.3 Conclusions</td>
<td>5</td>
</tr>
<tr>
<td>1.3 Infiltration and impact of ICT in Africa, and constraints on its use</td>
<td>5</td>
</tr>
<tr>
<td>1.3.1 Infiltration</td>
<td>5</td>
</tr>
<tr>
<td>1.3.2 Impact</td>
<td>6</td>
</tr>
<tr>
<td>1.3.3 Conclusions</td>
<td>9</td>
</tr>
<tr>
<td>1.4 The Southern African Development Community (SADC) and ICT</td>
<td>9</td>
</tr>
<tr>
<td>1.4.1 SADC</td>
<td>9</td>
</tr>
<tr>
<td>1.4.2 SADC and ICT</td>
<td>10</td>
</tr>
<tr>
<td>1.4.3 Telecommunications in SADC</td>
<td>11</td>
</tr>
<tr>
<td>1.4.4 Conclusions</td>
<td>11</td>
</tr>
<tr>
<td>1.5 ICT use and needs in six SADC countries</td>
<td>12</td>
</tr>
<tr>
<td>1.6 Issues in ICT Management in six universities in the six countries</td>
<td>14</td>
</tr>
<tr>
<td>1.6.1 The six universities</td>
<td>14</td>
</tr>
<tr>
<td>1.6.2 Issues in ICT Management in six universities</td>
<td>14</td>
</tr>
<tr>
<td>1.6.3 Conclusions</td>
<td>16</td>
</tr>
<tr>
<td>1.7 The problem area and the research proposition</td>
<td>17</td>
</tr>
<tr>
<td>1.7.1 Defining the problem area</td>
<td>17</td>
</tr>
<tr>
<td>1.7.2 The research proposition</td>
<td>17</td>
</tr>
<tr>
<td>2. Research Approach</td>
<td>19</td>
</tr>
<tr>
<td>2.1 Introduction</td>
<td>19</td>
</tr>
<tr>
<td>2.2 Research Methodology</td>
<td>19</td>
</tr>
<tr>
<td>3. Research Proposition</td>
<td>23</td>
</tr>
<tr>
<td>3.1 Introduction</td>
<td>23</td>
</tr>
<tr>
<td>3.2 Workshop objective</td>
<td>23</td>
</tr>
<tr>
<td>3.3 Workshop participants and programme</td>
<td>24</td>
</tr>
<tr>
<td>3.3.1 Workshop participants</td>
<td>24</td>
</tr>
<tr>
<td>3.3.2 The workshop programme</td>
<td>24</td>
</tr>
<tr>
<td>3.4 The workshop proceedings</td>
<td>25</td>
</tr>
<tr>
<td>3.4.1 Session 1: The context and objectives of the workshop</td>
<td>25</td>
</tr>
<tr>
<td>3.4.2 Session 2: Establishment of a common scientific base</td>
<td>25</td>
</tr>
<tr>
<td>3.4.3 Session 3: Presentations by the participating universities</td>
<td>28</td>
</tr>
<tr>
<td>3.4.4 Session 4: The five key ICT management components and proposition acceptance</td>
<td>29</td>
</tr>
<tr>
<td>3.5 Conclusions and Recommendations</td>
<td>31</td>
</tr>
<tr>
<td>4. Presentation of Applicable Models for Assessment of the Six Universities</td>
<td>33</td>
</tr>
<tr>
<td>4.1 Introduction</td>
<td>33</td>
</tr>
<tr>
<td>4.2 Summary description of the models</td>
<td>33</td>
</tr>
<tr>
<td>4.2.1 The MCM paradigm</td>
<td>33</td>
</tr>
<tr>
<td>4.2.1.1 Relationships between the entities</td>
<td>34</td>
</tr>
</tbody>
</table>
Assessing the University Eduardo Mondlane (UEM)................. 107
  7.1 Subjects and objects for assessment of the entity Real System
      using the MCM paradigm........................................... 108
  7.2 Subjects and objects for assessment of the entity ICT using the
      MCM paradigm.................................................... 116
  7.3 Subjects and objects for assessment of the entity MCM using the
      MCM paradigm.................................................... 119
  7.4 Subjects and objects for assessment of internal relationships
      using the MCM paradigm........................................... 121
  7.5 Subjects and objects for assessment of the external influences
      using the MCM paradigm........................................... 122
  7.6 Subjects and objects for assessment using the State Model/
      Extended State Model............................................. 125
  7.7 Subjects and objects for assessment using the Three Kinds of
      MCM Model and the Expansion of the Three Kinds of MCM
      Model.............................................................. 128
  7.7.1 Functional Management (FM)........................................ 128
  7.7.2 Application Management (AM)..................................... 129
  7.7.3 Technical Management (TM)...................................... 130
  7.8 Drawing conclusions for the Big ICT Five.......................... 132

Assessing the University of Namibia (UNAM)...................... 135
  8.1 Subjects and objects for assessment of the entity Real System
      using the MCM paradigm........................................... 136
  8.2 Subjects and objects for assessment of the entity ICT using the
      MCM paradigm.................................................... 143
  8.3 Subjects and objects for assessment of the entity MCM using the
      MCM paradigm.................................................... 146
  8.4 Subjects and objects for assessment of internal relationships
      using the MCM paradigm........................................... 149
  8.5 Subjects and objects for assessment of the external influences
      using the MCM paradigm........................................... 150
  8.6 Subjects and objects for assessment using the State Model/
      Extended State Model............................................. 152
  8.7 Subjects and objects for assessment using the Three Kinds of
      MCM Model and the Expansion of the Three Kinds of MCM
      Model.............................................................. 154
  8.7.1 Functional Management (FM)........................................ 154
  8.7.2 Application Management (AM)..................................... 156
  8.7.3 Technical Management (TM)...................................... 157
  8.8 Drawing conclusions for the Big ICT Five.......................... 159

Assessing the University of Swaziland (UNISWA)............... 161
  9.1 Subjects and objects for assessment of the entity Real System
      using the MCM paradigm........................................... 162
  9.2 Subjects and objects for assessment of the entity ICT using the
9.3 Subjects and objects for assessment of the entity MCM using the MCM paradigm............................................. 169
9.4 Subjects and objects for assessment of internal relationships using the MCM paradigm............................................. 172
9.5 Subjects and objects for assessment of the external influences with the MCM paradigm............................................. 174
9.6 Subjects and objects for assessment using the State Model/Extended State Model............................................. 175
9.7 Subjects and objects for assessment using the Three Kinds of MCM Model and the Expansion of the Three Kinds of MCM Model............................................. 177
9.7.1 Functional Management (FM)............................................. 179
9.7.2 Application Management (AM)............................................. 181
9.7.3 Technical Management (TM)............................................. 182
9.8 Drawing conclusions for the Big ICT Five............................................. 184

10. Assessing the University of Zambia (UNZA)............................................. 187
10.1 Subjects and objects for assessment of the entity Real System using the MCM paradigm............................................. 188
10.2 Subjects and objects for assessment of the entity ICT using the MCM paradigm............................................. 195
10.3 Subjects and objects for assessment of the entity MCM using the MCM paradigm............................................. 197
10.4 Subjects and objects for assessment of internal relationships using the MCM paradigm............................................. 200
10.5 Subjects and objects for assessment of the external influences using the MCM paradigm............................................. 202
10.6 Subjects and objects for assessment using the State Model/Extended State Model............................................. 203
10.7 Subjects and objects for assessment using the Three Kinds of MCM Model and the Expansion of the Three Kinds of MCM Model............................................. 205
10.7.1 Functional Management (FM)............................................. 205
10.7.2 Application Management (AM)............................................. 207
10.7.3 Technical Management (TM)............................................. 208
10.8 Drawing conclusions for the Big ICT Five............................................. 210

11. The Conceptual Model............................................. 213
11.1 Introduction............................................. 213
11.2 Step 1 - Structuring the Big ICT Five Model in such a way that it reflects the logical mutual relationships between the five subjects in practice............................................. 214
11.3 Step 2: Justifying the splitting of each main subject into five sub-subjects............................................. 215
11.4 Step 3: Showing the main subjects and, for each, their five sub-subjects in a diagram which is the basis for the next two steps............................................. 218
11.5 Step 4: Describing each main subject by means of a definition; a brief description (WHAT is it?); and a prescription for its accomplishment, by means of main directives (WHAT to do and HOW to do it) followed by literature references............................................. 220
11.5.1 ICT Strategy............................................. 220
11.5.2 ICT Development/Acquisition............................................. 222
11.5.3 ICT Implementation............................................. 223
11.5.4 ICT Utilization............................................. 224
11.5.5 ICT Service Management............................................. 224
11.6 Step 5: Describing, for each main subject, the five sub-subjects by
means of a definition, a brief description (WHAT it is), and a

prescription for their accomplishment, by means of directives

(WHAT to do and HOW to do it). .............................. 226

11.6.1 ICT Strategy ............................................. 226
11.6.1.1 Education and Research .............................. 226
11.6.1.2 Management and Administration ....................... 227
11.6.1.3 General services ..................................... 227
11.6.1.4 Security ........................................... 228
11.6.1.5 Investments and Costs ................................. 229
11.6.2 ICT Development/Acquisition ......................... 229
11.6.2.1 Development versus Acquisition ...................... 229
11.6.2.2 Requirements and Preconditions ....................... 230
11.6.2.3 Development Process ................................ 231
11.6.2.4 Acquisition Process .................................. 232
11.6.2.5 Selection Process .................................... 232
11.6.3 ICT Implementation ..................................... 233
11.6.3.1 Project Management ................................ 234
11.6.3.2 End-User Training .................................. 234
11.6.3.3 Management, Control and Maintenance Training ..... 235
11.6.3.4 Service Level Agreements .............................. 235
11.6.3.5 Testing ............................................ 236
11.6.4 ICT Utilization ......................................... 236
11.6.4.1 Effectiveness and Efficiency ......................... 237
11.6.4.2 User Skills ........................................ 237
11.6.4.3 Management, Control and Maintenance Relationships 238
11.6.4.4 Security Awareness ................................ 238
11.6.4.5 Cost Awareness ..................................... 239
11.6.5 ICT Service Management ................................. 239
11.6.5.1 Three Kinds of Management, Control and Maintenance 239
11.6.5.2 Service Support Subjects ............................... 240
11.6.5.3 Service Delivery Subjects ............................. 240
11.6.5.4 User Relationships .................................. 241
11.6.5.5 Charging ........................................... 241

12. System Realization .......................................... 243

12.1 Introduction ............................................. 243
12.2 Step 1. Recapitulation of the current situation of the technological resources, skills and the Big ICT Five Model in the universities .................. 243
12.3 Step 2: Presentation of the technological solution for the automation of the Big ICT Five Model .................. 244
12.4 Step 3. Transformation of the Big ICT Five Model into a class diagram ................................................. 246
12.4.1 ICT Strategy ........................................... 248
12.4.2 ICT Development/Acquisition ........................... 249
12.4.3 ICT Implementation ..................................... 250
12.4.4 ICT Utilization ........................................ 251
12.4.5 ICT Service Management ................................. 252
12.5 Step 4: Presentation of an action diagram showing the dynamic interfaces and sequences .......................... 254
12.6 Step 5: Creation and presentation of the interfaces .................. 259
12.7 Step 6: Populating the classes/objects with real data and launching the system online on the Internet .................. 265

13. Validation .................................................. 267

13.1 Introduction ............................................. 267
13.2 Step 1: Preparation of questions(s) concerning the assessments made of the six universities, with the aim of verifying whether
they are correct................................................................. 268
13.3 Step 2: Preparation of question(s) concerning the conceptual
model, with the aim of verifying its usefulness......................... 268
13.4 Step 3: Preparation of question(s) concerning the automated tool,
with the aim of verifying its effectiveness.................................. 268
13.5 Step 4: Preparation of a letter to be sent to the universities, setting
out the three categories of questions developed in steps 1-3............. 268
13.6 Step 5: Compilation and synthesis of the responses from the six
Universities........................................................................... 269
13.7 Step 6: Conclusions regarding the validity of the research output.... 271

14. Epilogue.............................................................................. 273
14.1 Summary of the Research Findings based on author’s experience
in this research...................................................................... 273
14.1.1 Exploration of the research problem................................. 273
14.1.2 The research approach.................................................... 274
14.1.3 Application of the management models........................... 275
14.1.4 Conclusions based on the application of the management models.. 275
14.1.5 The model........................................................................ 275
14.1.6 The automated system...................................................... 276
14.2 Conclusion with regard to the research results and the utilization
and application of the model and the automated system................ 276
14.3 Recommendations for further research................................ 277

Bibliography and References.................................................. 279

Annexes
1. List of Participants at the Workshop on Management and Control of
   ICT in Institutions of Higher Education in Southern Africa........... 289
2. The Letter Sent to the Six Universities..................................... 290
3. Presentation of the Responses Received from the Six Universities... 292

Samenvatting (Nederlands)..................................................... 299

About the Author.................................................................... 305

Index of authors..................................................................... 307

Index of subjects.................................................................... 311
**LIST OF TABLES AND FIGURES**

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1.3.1</td>
<td>Recent initiatives for Africa by selected ICT donors and regional institutions</td>
<td>7</td>
</tr>
<tr>
<td>Table 1.4.1</td>
<td>Summary of progress in the telecommunications sector of SADC (until 1999)</td>
<td>11</td>
</tr>
<tr>
<td>Table 1.5.1</td>
<td>Synopsis of the six countries</td>
<td>13</td>
</tr>
<tr>
<td>Table 1.6.1</td>
<td>General data and selected indicators of ICT penetration in the six Universities</td>
<td>16</td>
</tr>
<tr>
<td>Table 4.2.1</td>
<td>FM task areas/task fields</td>
<td>41</td>
</tr>
<tr>
<td>Table 4.2.2</td>
<td>AM task areas/task fields</td>
<td>42</td>
</tr>
<tr>
<td>Table 4.2.3</td>
<td>TM task areas/task fields</td>
<td>43</td>
</tr>
<tr>
<td>Table 5.1.1</td>
<td>Academic and non-academic staff and student population for each unit, and courses offered by UoB, 2001</td>
<td>53</td>
</tr>
<tr>
<td>Table 5.2.1</td>
<td>UoB Networking Infrastructure (2001)</td>
<td>60</td>
</tr>
<tr>
<td>Table 5.7.1</td>
<td>Functional Management tasks undertaken by the different parties at UoB</td>
<td>71</td>
</tr>
<tr>
<td>Table 5.7.2</td>
<td>Application Management tasks undertaken by different the parties at UoB</td>
<td>72</td>
</tr>
<tr>
<td>Table 5.7.3</td>
<td>Technical Management tasks undertaken by the different parties at UoB</td>
<td>74</td>
</tr>
<tr>
<td>Table 6.1.1</td>
<td>Academic and non-academic staff and student population by units and courses offered by UDSM</td>
<td>79</td>
</tr>
<tr>
<td>Table 6.2.1</td>
<td>Networking infrastructure capacity of UDSM</td>
<td>87</td>
</tr>
<tr>
<td>Table 6.7.1</td>
<td>Functional Management tasks undertaken by the different parties at UDSM</td>
<td>100</td>
</tr>
<tr>
<td>Table 6.7.2</td>
<td>Application Management tasks undertaken by the different parties at UDSM</td>
<td>101</td>
</tr>
<tr>
<td>Table 6.7.3</td>
<td>Technical Management tasks undertaken by the different parties at UDSM</td>
<td>103</td>
</tr>
<tr>
<td>Table 7.1.1</td>
<td>Academic, non-academic and student population breakdown by units and courses offered by UEM, 2000</td>
<td>109</td>
</tr>
<tr>
<td>Table 7.2.1</td>
<td>Communication Facilities Capacity, UEM, 2001</td>
<td>117</td>
</tr>
<tr>
<td>Table 7.7.1</td>
<td>Functional Management tasks undertaken by the different parties at UEM</td>
<td>128</td>
</tr>
<tr>
<td>Table 7.7.2</td>
<td>Application Management tasks undertaken by different parties at UEM</td>
<td>130</td>
</tr>
<tr>
<td>Table 7.7.3</td>
<td>Technical Management tasks undertaken by the different parties at UEM</td>
<td>131</td>
</tr>
<tr>
<td>Table 8.1.1</td>
<td>Academic, non-academic and student population breakdown by units and courses offered by UNAM, 2000</td>
<td>137</td>
</tr>
<tr>
<td>Table 8.2.1</td>
<td>Networking infrastructure of UNAM</td>
<td>144</td>
</tr>
<tr>
<td>Table 8.7.1</td>
<td>Functional Management tasks undertaken by the different parties at UNAM</td>
<td>155</td>
</tr>
<tr>
<td>Table 8.7.2</td>
<td>Application Management tasks undertaken by different parties at UNAM</td>
<td>156</td>
</tr>
<tr>
<td>Table 8.7.3</td>
<td>Technical Management tasks undertaken by the different parties at UNAM</td>
<td>158</td>
</tr>
<tr>
<td>Table 9.1.1</td>
<td>Academic, non-academic and student population by units and courses offered by UNISWA, 2000</td>
<td>164</td>
</tr>
<tr>
<td>Table 9.2.1</td>
<td>Communications facilities capacity at UNISWA, 2001</td>
<td>171</td>
</tr>
<tr>
<td>Table 9.7.1</td>
<td>Functional Management tasks undertaken by the different parties at UNISWA</td>
<td>180</td>
</tr>
<tr>
<td>Table 9.7.2</td>
<td>Application Management tasks undertaken by different parties at UNISWA</td>
<td>181</td>
</tr>
</tbody>
</table>
Table 9.7.3 Technical Management tasks undertaken by the different parties at UNISWA...................................................... 183
Table 10.1.1 Academic, non-academic and student population breakdown by units and courses offered by UNZA, 2001.................. 190
Table 10.2.1 Communication facilities capacity at UNZA, 2001........................... 196
Table 10.7.1 Functional Management tasks undertaken by the different parties at UNZA.......................................................... 206
Table 10.7.2 Application Management tasks undertaken by different Parties at UNZA.............................................................. 207
Table 10.7.3 Technical Management tasks undertaken by the different parties at UNZA................................................... 209

List of figures

Figure 1.1.1 Exploration by using a step-by-step approach........................................ 2
Figure 2.2.1 The Research Methodology.................................................................. 21
Figure 3.2.1 Participants to the Workshop on Management and Control of ICT in Institutions of Higher Education in Southern Africa, March 25, 2000......................................................... 24
Figure 3.3.1 Main Workshop sessions and proceedings............................................. 25
Figure 4.2.1 MCM Paradigm.................................................................................... 33
Figure 4.2.2 External Influence – Governance...................................................... 36
Figure 4.2.3 The expansion of the RS entity......................................................... 38
Figure 4.2.4 The expansion of the ICT entity....................................................... 38
Figure 4.2.5 The expansion of the MCM entity...................................................... 39
Figure 4.2.6 State Model....................................................................................... 39
Figure 4.2.7 Extended State Model...................................................................... 40
Figure 4.2.8 Three Kinds of MCM....................................................................... 41
Figure 4.2.9 The Mintzberg Logo applied to a university..................................... 44
Figure 4.2.10 The Triple Model of MCM.............................................................. 45
Figure 5.1.1 The Mintzberg Logo applied to UoB.................................................... 53
Figure 5.1.2 Organization Chart of UoB Administrative Structure, 2000.............. 55
Figure 5.1.3 Ongoing processes at UoB, 2001....................................................... 57
Figure 5.2.1 University of Botswana ICT Infrastructure, 2001.............................. 61
Figure 5.3.1 University Computer Centre Organization Chart............................... 63
Figure 6.1.1 The Mintzberg Logo applied to UDSM............................................ 79
Figure 6.1.2 Organization chart of the UDSM administrative structure (2001)........ 81
Figure 6.1.3 Ongoing processes at UDSM............................................................ 83
Figure 6.2.1 University of Dar Es Salaam infrastructure, 2001............................ 88
Figure 6.3.1 Organizational structure of the UDSM Computer Centre............... 91
Figure 6.5.1 External influences on university governance, UDSM...................... 95
Figure 7.1.1 The Mintzberg Logo applied to UEM.............................................. 109
Figure 7.1.2 Organization Chart of UEM Administrative Structure.................... 112
Figure 7.1.3 Ongoing Processes at UEM............................................................... 113
Figure 7.2.1 University Eduardo Mondlane infrastructure, 2001.......................... 118
Figure 7.3.1 Organization Chart of CIUEM.......................................................... 119
Figure 7.5.1 External influences on university governance, UEM....................... 123
Figure 8.1.1 The Mintzburg Logo applied to UNAM......................................... 137
Figure 8.1.2 Organization chart of UNAM administrative structure.................. 140
Figure 8.1.3 Ongoing processes at UNAM......................................................... 142
Figure 8.2.1 University of Namibia ICT Infrastructure........................................ 145
Figure 8.3.1 a) UNAM Computer Centre – current organization chart, 2001........ 146
Figure 8.3.1 b) UNAM Computer Centre – proposed organization chart, possibly to be approved with the ICT strategy............................... 147
Figure 9.1.1 Mintzberg Logo applied to UNISWA............................................... 163
Figure 9.1.2 Organization chart of UNISWA administrative structure, 2001........ 166
Figure 9.1.3 Ongoing processes at UNISWA .......................................................... 167
Figure 9.2.1 UNISWA ICT infrastructure .......................................................... 170
Figure 9.3.1 Computer Centre organisation chart of UNISWA, 2001 ............... 172
Figure 10.1.1 Mintzberg Logo applied to UNZA .............................................. 189
Figure 10.1.2 Organization chart of University of Zambia administrative structure, 2001 .......................................................... 192
Figure 10.1.3 On Going Processes at UNZA, 2001 ........................................... 193
Figure 10.2.1 University of Zambia ICT infrastructure ..................................... 197
Figure 10.3.1 UNZA Computer Centre organization chart ................................ 198
Figure 11.2.1 Preliminary design of the Big ICT Five Model .............................. 214
Figure 11.4.1 Main subject and sub-subject structure of the Big ICT Five .......... 219
Figure 12.3.1 Client Server Concept ................................................................. 244
Figure 12.3.2 Technical Realization of The Big ICT Five Model ......................... 245
Figure 12.4.1 Mapping the Big ICT Five Model into a Class Diagram ............... 247
Figure 12.4.2 Class Diagram ICT Strategy – STR ............................................. 248
Figure 12.4.3 Class Diagram ICT Development/Acquisition – DAC .................. 249
Figure 12.4.4 Class Diagram ICT Implementation – IPL ................................. 250
Figure 12.4.5 Class Diagram ICT Utilization – UTZ ......................................... 251
Figure 12.4.6 Class Diagram ICT Service Management – SMG ....................... 252
Figure 12.4.7 The Big ICT Five Class Diagram and Relationships among Objects 253
Figure 12.5.1 Action Diagram ICT Strategy ...................................................... 254
Figure 12.5.2 Action Diagram Development/Acquisition .................................... 255
Figure 12.5.3 Action Diagram ICT Implementation .......................................... 256
Figure 12.5.4 Action Diagram ICT Utilization ................................................... 257
Figure 12.5.5 Action Diagram ICT Service Management .................................... 258
LIST OF ABBREVIATIONS

AAU  Association of African Universities
ADF  African Development Forum
AGRIS Agricultural Information System
AI   Acceptance and Implementation State
AISI  African Information Society Initiative
AM   Application Management
ARIS  Academic Registry Information System
AVU  African Virtual University
BEF  Belgian Francs
BSD  Berkeley Software Development
BTA  Botswana Telecommunications Authority
BTC  Botswana Telecommunications Corporation
CATS Tanzanian Internet service provider
CAZ  Communications Authority of Zambia
CC   computer centre
CIUDEM Centro de Informática da University Eduardo Mondlane
CMM  Capacity Maturity Model
CMS  content management system
COMESA Common Market for East and Southern Africa
CPInfo Comissão para a Política de Informática, Mozambique
CS3  accounting information system, being introduced at University of Zambia
DBMS Database Management System
DDE  Department of Distance Education, University of Zambia
DEEL Departamento de Engenharia Electrotécnica, University Eduardo Mondlane
DEVISIS Development Sciences Information System
DIS  Distance Education Information System
DMI  Departamento de Matemática e Informática, University Eduardo Mondlane
DS Department of Supply (Botswana, Ministry of Finance and Development Planning)
DSSS Direct Sequence Spread Spectrum
E State Exploitation state
ECOWAS Economic Community of West African States
EDM Electricidade de Moçambique
EIS  Educational Information System
EMUNet Eduardo Mondlane University Network
FAO United Nations Food and Agriculture Organization
FIS  Finance Information System
FM  Functional Management
FRD  Foundation for Research Development, South Africa
Gbps gigabytes per second
GDP  gross domestic product
GIU  Gabinete de Instalações Universitárias, (physical infrastructure unit) University Eduardo Mondlane
GKP  Global Knowledge Partnership (The World Bank)
HE  higher education
HEM  Hardware Engineering and Maintenance Department, University Computer Centre Ltd, Dar-Es-Salaam
HRM  human resources management
HTML Hyper text markup language
ICT  information and communications technology/ies
IDRC International Development Research Centre
ILRC Information and Learning Research Centre, University of Namibia
IMS  Institute of Marine Science, Zanzibar
INCM Instituto Nacional de Comunicações de Moçambique
INESOR Institute of Economic and Social Research, University of Zambia
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>INFOPOL</td>
<td>Information Policy</td>
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<tr>
<td>INNOPAC</td>
<td>A library information system</td>
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<tr>
<td>IP</td>
<td>Internet protocol</td>
</tr>
<tr>
<td>IPA</td>
<td>Investment Promotion Agency, Botswana</td>
</tr>
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<td>IPP</td>
<td>ICT Policy Plan</td>
</tr>
<tr>
<td>IPP</td>
<td>Information Policy and Information Planning State</td>
</tr>
<tr>
<td>ISDU</td>
<td>Information Systems Dissemination Unit, University of Swaziland</td>
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<tr>
<td>ISP</td>
<td>Internet service provider</td>
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<tr>
<td>IT</td>
<td>information technologies</td>
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<td>ITS</td>
<td>Integrated Tertiary Software (a software company)</td>
</tr>
<tr>
<td>ITU</td>
<td>International Telecommunications Union</td>
</tr>
<tr>
<td>IWWW</td>
<td>a Namibian Internet service provider</td>
</tr>
<tr>
<td>Kbps</td>
<td>kilobytes per second</td>
</tr>
<tr>
<td>LAN</td>
<td>Local area network</td>
</tr>
<tr>
<td>LIBIS</td>
<td>Library Information System</td>
</tr>
<tr>
<td>M1 State</td>
<td>Minor changes/modifications state (maintenance)</td>
</tr>
<tr>
<td>M2 State</td>
<td>Major changes/modifications state</td>
</tr>
<tr>
<td>MAE</td>
<td>Ministry of State Administration, Mozambique</td>
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<tr>
<td>MAN</td>
<td>Metropolitan Area Network</td>
</tr>
<tr>
<td>Mbps</td>
<td>megabytes per second</td>
</tr>
<tr>
<td>MCM</td>
<td>Management, Control and Maintenance</td>
</tr>
<tr>
<td>MD</td>
<td>Marketing Department, University Computer Centre Ltd, Dar-Es-Salaam</td>
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<tr>
<td>MESCT</td>
<td>Ministry of Higher Education, Science and Technology, Mozambique</td>
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<tr>
<td>MF</td>
<td>Ministry of Finance</td>
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<td>MHO</td>
<td>Joint Financing Programme for Cooperation in Higher Education (Netherlands</td>
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<td>MIS</td>
<td>Ministry for Development Cooperation)</td>
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<tr>
<td>MIT</td>
<td>management information system</td>
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<td>MLYDS</td>
<td>Ministry of Youth, Development and Sports, Tanzania</td>
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<td>MPF</td>
<td>Ministry of Planning and Finance, Mozambique</td>
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<td>MSTHE</td>
<td>Ministry of Science, Technology and Higher Education, Tanzania</td>
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<tr>
<td>MUCHS</td>
<td>Muhimbili University College of Health Sciences, University of Dar-Es-Salaam</td>
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<tr>
<td>mySQL</td>
<td>database management software (my structured query language)</td>
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<td>NAIS</td>
<td>National Advanced Institute of Science &amp; Technology, Japan</td>
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<td>NCC</td>
<td>Namibia Communications Commission</td>
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<tr>
<td>NORAD</td>
<td>Norwegian Development Agency</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Cooperation and Development</td>
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<tr>
<td>ooa</td>
<td>object oriented analysis</td>
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<tr>
<td>OPAC</td>
<td>on-line public access catalogue</td>
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<tr>
<td>PC</td>
<td>personal computer</td>
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<tr>
<td>PHP</td>
<td>Programming Hypertext Processor - scripting language for WEB programming</td>
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<tr>
<td>PICTA</td>
<td>Association for information and communication in Africa</td>
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<td>PIS</td>
<td>Personnel Information System</td>
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<tr>
<td>PMIS</td>
<td>Project Management Information System</td>
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<td>PMMO</td>
<td>Principal Manpower Management Officer, University of Dar-Es-Salaam</td>
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<tr>
<td>PPIS</td>
<td>Personnel and Payroll Information Systems</td>
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<tr>
<td>PTO</td>
<td>Public Telephone Operator</td>
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<td>PTT</td>
<td>Post, telegraphy and telephone</td>
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<td>PyIS</td>
<td>Payroll Information System</td>
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<td>RFMS</td>
<td>Reform of Finance Management System, University Eduardo Mondlane</td>
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<td>RFP</td>
<td>request for proposals</td>
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<tr>
<td>RIS</td>
<td>Research Information System</td>
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<tr>
<td>RS</td>
<td>real system</td>
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<td>RUMA</td>
<td>Reform of University Management and Administration, University Eduardo Mondlane</td>
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<td>SADC</td>
<td>Southern African Development Community</td>
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SADCC  Southern African Development Coordinating Conference
SAREC  Swedish Agency for Research Cooperation
SATCC  Southern African Transport and Communications Commission
SCALA  a library information system
SCD  Service Control Department, University Computer Centre Ltd, Dar-Es-Salaam
SEM  Software Engineering and Maintenance Department, University Computer Centre Ltd, Dar-Es-Salaam
SIDA  Swedish International Development Agency
SITA  a Tanzanian Internet service provider
SLA  Service Level Agreement
SOM  School of Medicine, University of Zambia
SPTC  Swaziland Post and Telecommunications Corporation
SQL  structured query language
SRS  Student Records Information System
SWOT  Strengths, Weaknesses, Opportunities Threats
TA  technical assistance
TCC  Tanzania Communications Commission
TD  Training Department, University Computer Centre Ltd, Dar-Es-Salaam
TDM  Telecomunicações de Moçambique
TM  Technical Management
TNCs  transnational corporations
TTCL  Tanzanian Telecommunications Co Ltd.
U State  Utilization State
UBBS  University of Basutoland, Bechuanaland and Swaziland
UBLS  University of Botswana, Lesotho and Swaziland
UCLAS  University College of Lands and Architectural Studies, University of Dar-Es-Salaam
UDSM  University of Dar-Es-Salaam
UEM  University Eduardo Mondlane
ULM  Universidade de Lourenço Marques
UNAM  University of Namibia
UNDP  United Nations Development Programme
UNECA  United Nations Economic Commission for Africa
UNESCO  United Nations Educational, Scientific and Cultural Organization
UNFPA  United Nations Population Fund
UNISWA  University of Swaziland
UNZA  University of Zambia
UoB  University of Botswana
URICA  a library information system
USAID  United States Agency for International Development
USD  United States Dollar
UTLIP  University Teaching, Learning Improving Programme, University of Dar-Es-Salaam
UTP  Unshielded Twisted Pair
UUCP  Unix to Unix copy program
UUNet  Namibian Internet service provider
VLIR  Vlaamse Interuniversitaire Raad (Flemish Interuniversity Council)
VSAT  very small aperture terminal
WHO  World Health Organisation
WAN  Wide Area Network
1. EXPLORING THE PROBLEM AREA

The objective of this chapter is to identify and to delineate the area to be explored, which is related to Information and Communication Technologies (ICT). In order to do this, we briefly review ICT developments worldwide and then, in five steps, gradually reduce our field of view to focus on ICT management issues in universities. Through this process, we define the problem area and a research proposition.

1.1 Introduction

Countries in the developed world are increasingly dependent on ICT for the pursuit of their objectives. In terms of technological development, their ICT industry produces ever more complex and sophisticated computer hardware and software. In addition to Internet and its associated technologies, communications hardware and software are being developed for specific areas such as health, education, agriculture, and public services.

To assist the effective exploitation and use of this technology, and to minimize possible negative impacts of ICT (e.g. loss of privacy and ICT piracy), developed countries produce and disseminate knowledge on ICT for users, managers and ICT professionals to support them in the development, implementation, use and management of services related to ICT. Moreover, with the same objective, they also produce new strategies, methods and techniques related to ICT.

Hardware and software produced by the developed countries is exported for use in Africa. However, questions can be raised concerning the efficiency and effectiveness of use of all ICT brought to Africa, because the knowledge necessary for effective use and exploitation is not being transferred at the same speed as the technology itself. From among the many problems relating to ICT in Africa, in this exploration we focus especially on issues of strategies, development and acquisition of technologies, implementation, utilization and service management.

The problem area is delineated using a step-by-step approach, as illustrated in Figure 1.1.1. Based on a literature survey, we begin by outlining some strategic trends in ICT at the global level, gradually focussing down, in five steps, to the specific object of exploration.

Step 1 A brief overview of ICT in developed countries, summarising aspects such as ICT industry, ICT suppliers, education, and forums for dissemination (Section 1.2).

Step 2 Infiltration of ICT into Africa, covering the role of the developed world and international donors in transferring ICT to Africa, the impact of infiltration of ICT in Africa, and the constraints on effective ICT use (Section 1.3).

Step 3 ICT in the Southern Africa Development Community (SADC), in which we define SADC and review progress in the development and implementation of ICT policies and strategies within the organisation (Section 1.4).

Step 4 ICT in six countries of SADC, (Botswana, Mozambique, Namibia, Swaziland, Tanzania, and Zambia), outlining the current state of development and ICT use in business, education, government, research, and industry (Section 1.5).

Step 5 ICT in six universities in the SADC region (Universities of Botswana, Namibia, Swaziland, Zambia, Dar Es Salaam [Tanzania] and Eduardo Mondlane [Mozambique]), identifying the issues which constrain effective management and use of ICT (Section 1.6).
Chapter 1: Exploring the problem area

Overview of ICT in developed countries
- Industry
- Suppliers
- Systems/packages
  - Hardware
  - Software
- Communications/Internet
- Conferences
- Publications
- Education

USA, Asia, Europe are the major producers of:
- Knowledge/education
- Internet (communication)
- Hardware/software

Step 1

General overview of ICT infiltration and Africa-wide consequences
Infiltration of:
- Hardware/software
- Knowledge/education
- Telecommunications & data networks
  - Internet
Consequences:
Africa confronted by vast number of ICT products and ideas

The role of developed world/donors/multi- and bilateral agencies in hardware and software transfer to Africa.

Step 2

Africa (54 countries)

SADC and ICT
How does SADC focus on ICT?

Define/describe SADC and determine how SADC responds to ICT transfer

Step 3

SADC (14 countries)

ICT use and needs in 6 SADC Countries
Determine the need for ICT in business and education in six countries

Needs for applying ICT to business and education

6 countries: Botswana, Tanzania, Mozambique, Namibia, Swaziland & Zambia

Step 4

ICT in 6 universities
Issues in relation to strategy, Development/acquisition, Implementation, utilization and service management

Determine how the six universities are dealing with issues such as strategy, development/acquisition & implementation in research and administration, as well as utilization of and support to ICT.

Step 5

6 universities: UoB, UDSM, UEM, UNAM, UNISWA and UNZA

Problem Area

Research Proposition

Figure 1.1.1 Exploration by using a step-by-step approach
Chapter 1: Exploring the problem area

1.2 A brief overview of ICT in developed countries

1.2.1 The 'Information Era'

Until the mid 20th century, the main purpose of human labour was to produce material objects, and a nation’s economic power was measured by its material resources. By the beginning of the 21st century, however, the main strategic object of labour in the most highly industrialised countries had become the production, processing and dissemination of information. Thus, contemporary industrial society entered a new epoch of technological development: the 'Information Era' [Oettinger1980].

This growing dependence on information and the means for its transmission and processing (the so-called Information and Communication Technologies – ICT) has led to the concept of 'National Information Resources' as a key national asset in industrialised countries. Oettinger has even suggested that information has become a basic economic resource, on a par with materials and energy [Oettinger1980].

In a period of increasing globalisation, the concept of information as an economic resource has significant corollaries, including the following:

- Real-time, global communication has become integral to the activities of governments, businesses and institutions worldwide;
- Trans-national corporations (TNCs) compete for control over information, the most valued resource; and
- The science of managing information - ICT management - has been established as an academic discipline in many institutions.

1.2.2 Overview of the ICT industry in developed countries

The ICT market sector contributes 15 - 25% of the gross national product in OECD countries and about 14% in the USA [UNESCO1999]. In such countries, the ICT industry is characterised by:

- Many different types of ICT produced for similar consumer activities
- More and newer ICT products, reaching the market with increasing speed
- More complex and sophisticated ICT produced and more research activities established
- A project-oriented approach to production technologies, with several manufacturers in different countries contributing to the same final product
- Specialist ICT products for almost all sectors (e.g. commerce, governance, health and education)
- Company mergers, alliances and partnerships, so that a few companies control the worldwide market in ICT
- Outsourcing and downsizing of ICT organizations and ICT activities
- Improving user/consumer confidence in ICT products by increasing their security.
- An increasing number of organizations providing services for ICT audit, purchase and piracy control

1.2.2.1 ICT trade and suppliers

The total value of ICT exports worldwide grew by 75% between 1992 and 1996 [UNESCO 1999], mainly as a result of new sales methods by ICT suppliers, such as:

- Buying and selling of ICT products via the Internet, using credit/debit cards;
- Forming chains of dealers/re-sellers/dealers worldwide, involving many people with different roles and qualifications.
1.2.2.2 ICT and telecommunications products

Worldwide investments in telecommunications by developed countries rose by 25% in the last five years. The American organisation 'Fortune' names the ICT industry as the world's fastest-growing industry, with the strongest growth rates in the mobile communication and the Internet market. 20% of the fifty largest companies in the world are ICT companies [UNESCO1999]. Through them, a wide range of ICT products are produced, including the following:

- Computer hardware,
- Operating system software
- Internet
- Software applications (e.g. word processing, statistical packages, educational software)
- Data bases
- Communication mediums (e.g. satellites, radio link hardware, cables)
- WEB engineering tools and products
- Communication devices
- Mobile phones
- Fixed phones

1.2.2.3 Worldwide Conferences/Forums

Numerous international conferences on ICT have taken place, at different levels and for different interest groups such as policy makers, governments, ICT industry, multi-and bilateral aid agencies, education and research institutions. At such meetings, developed countries generally try to define international strategies for ICT. By the end of the 1990s, the provision of ICT to the developing world had become a major interest of the developed world, as demonstrated by the following:

- A Global Knowledge Partnership [World Bank1999] brought together all major multi- and bilateral development agencies and many civil society organisations, to identify concrete ways of using new technologies to apply knowledge for development.
- The theme of the Millennium Session of the United Nations Economic and Social Council was ICT and Development.
- The G8 group of leading industrialised countries announced its willingness to invest heavily in ICT for development and established a task force to map a strategy (Dot Force) made up of governments, civil society organisations and businesses.
- The Global Information Infrastructure Initiative.
- The Centre for Educational Research and Innovation activities [www.oecd.org].

1.2.2.4 Education

In developed countries, the growing demand for education in ICT has been met in various ways:

- Through the development of specialized ICT programmes in institutions of education and research, in both the private and public/government sectors (e.g. ICT University in Sweden, MIT in United States, National Advanced Institution of Science and Technology - NAIS, in Japan).
- Through the revision of school curricula, to emphasise ICT training at school and undergraduate level.
- Through the introduction of ICT disciplines in curricula for non-technical courses, to train future graduates in ICT use.

Clearly, in developed countries, funds are available for new infrastructures, new teaching mediums, and new teaching skills, methods and techniques.
1.2.2.5 Publications

The production and circulation of knowledge has a high priority in industrialised countries. Publications on ICT, including technical and scientific journals, ICT industry literature, popular articles in newspapers etc. and resolutions of international forums are easily obtainable in education and research institutions, public libraries, bookshops, kiosks, and shops.

1.2.3 Conclusions

The fast pace of technological change is exacerbating a situation in which knowledge related to the production, management and application of ICT is concentrated in the developed countries.

With the involvement of many new commercial players in ICT (suppliers) in the networking environment of the new information economy in developed countries, ICT managers (and, indeed, ICT users) need to acquire new knowledge and new skills and deal with new financing schemes. The Internet offers access to information and expertise that can be used to build human capacity in ICT, to increase business and contribute to national economic and social growth. Developed countries can exploit these opportunities, as they possess the necessary strategies and skills to use the ICT and Internet efficiently and effectively.

The ICT developments taking place in the developed world are also felt in one way or another in developing countries. In section 1.3 we look into how infiltration of ICT takes place in Africa by finding out the role of the developed world and international donors in ICT transfer, the impact of infiltration of ICT and the constraints on effective ICT use in Africa.

1.3 Infiltration and impact of ICT in Africa, and constraints on its use

1.3.1 Infiltration

The introduction of information and communication technologies into developing countries has been driven largely by the development organisations (multilateral and bilateral) that emerged in the 1950s to help bridge the “poverty gap” between the developed and the so-called developing countries. Historically, changing trends can be identified, in accordance with the development itself [www.sas.upenn.edu/African_studies/padis/menu_padis.html]:

- From the 1950s to the 1970s, the emphasis was on introducing computing to support public administration – for example, health administration, revenue collection, university administration; this is a continuing theme.
- From the late 1960s, greater emphasis was placed on information needs for development: at this time international bibliographic information systems (for example, AGRIS, the international agricultural information system, and DEVGIS, the development sciences information system) were developed with the aim of building capacities in developing countries for capturing local and global scientific information and applying it to development problems; these were accompanied by programmes to automate library and documentation functions in universities and government departments.
- In the mid 1980s, following the introduction of the personal computer and first versions of the Internet, a few pilot projects attempted to apply networking technologies in development [Jensen1998, mikey@sn.apc.org and http://www3.sn.apc.org/projects.htm].
- From the early 1990s, interest in the Internet as a tool for development – in particular as a means of enabling developing countries to leapfrog stages of development – grew rapidly. Two main program streams have emerged: the first addresses bottlenecks in access to communication technologies through national information policy, telecommunication policy reform, new wireless technologies and community access models; the second attempts to mainstream ICT applications.
in traditional development sectors [The World Bank1999 and Mansell1998]. During this period, a satellite and radio communication-based infrastructure became an option for communication and data transfer for non-military applications in Africa.

In 2000, Sub-Saharan Africa achieved a telephone density of one subscriber per 100 inhabitants [www.itu.org October 2001]. Figures presented by Mike Jensen in February 2002 [mikej@sn.apc.org http://www.3.sn.apc.org/projects.htm, http://www.3.sn.apc.org/Africa] indicate that about 0.76% of the 770 million people in Africa have a PC, 0.71% use the Internet, 2.56% have a fixed telephone line and 2.56% have a GSM line. Compared to Europe and America, these numbers are still very low. Given the lack of infrastructure and the low level of penetration of fixed lines, the number of GSM connections has increased rapidly and by 2000 was already equal to the number of fixed lines – an example of technological ‘leapfrogging’ in the African telecommunications field.

Delivery of ICT to Africa has not been driven by manufacturers responding to, or looking for market opportunities. Instead, international aid agencies, both bilateral and multi-lateral, have been responsible for introducing information technologies. Among these agencies, the most important have been the World Bank, UNDP, SIDA, UNESCO and IDRC, which have made available substantial sums for purposes related to ICT.

Most of these agencies were not specialised in ICT, nor aware of its development potential. Although investments in ICT had some immediate impact, they were often not sustainable for reasons such as lack of qualified personnel and lack of local funds for operations and maintenance. Very few of the projects carried out by these agencies were concerned with management of ICT, although Shahid Akhtar [1990] considers management to be one of the most important factors for sustainability of ICT systems. In general, development agencies dealt with ICT for Africa from their offices in Europe, America and Japan and had little appreciation of the human and institutional constraints at the project location.

As early as the 1980s, IDRC and some other agencies perceived the need to progress from ICT-related projects to ICT as a specific development sector [Browne1990]. This tendency received renewed impetus in the first half of the 1990s, with the development of the Internet. Table 1.3.1 shows how a wide range of donors were involved in ICT projects in many sectors by the late 1990s.

Internet penetration in Africa started slowly, and at the end of 1996 only 11 countries had Internet access. By November 2000, however, all 54 African countries had achieved permanent connectivity. In 2000, the number of computers permanently connected to the Internet in Africa is estimated to be around 30,000, compared with 10,000 in 1999, showing a growth of 200% in one year. They are, however, concentrated overwhelmingly in urban areas, especially the capital cities. In 2002, Internet points of presence are being established in some secondary towns in Algeria, Angola, Botswana, Democratic Republic of Congo, Egypt, Ghana, Kenya, Madagascar, Morocco, Mozambique, Namibia, Nigeria, Tanzania, Tunisia, Zambia and Zimbabwe and South Africa. Rural penetration is still insignificant, even though the majority of Africans live in rural areas [www.itu.org]. To redress this imbalance, ICT policy/strategy has emerged as a major area of concern within aid organisations and African governments.

1.3.2 Impact

The global information era finds Africa at a complex stage of development, characterised by economic, political and social adjustment, and with little ICT industry. The ICT consumer market consists largely of governments and international and non-governmental organisations (NGOs). Africa has a very small private sector. The very limited number of people with scientific and technical knowledge in the field of ICT makes it difficult to introduce innovations in technology to support Africa’s development objectives.
<table>
<thead>
<tr>
<th>Organization</th>
<th>ICT Development Area</th>
<th>Start Date</th>
<th>Level Of Coverage in Africa</th>
<th>Level Of Funding</th>
<th>Driven By</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNECA</td>
<td>Policy and Development programmes</td>
<td>AISI 1995</td>
<td>All Africa</td>
<td>Information not available</td>
<td>ECA</td>
</tr>
<tr>
<td>ITU</td>
<td>Telecommunication Health Policy and Infrastructure Health Telecentre</td>
<td>-</td>
<td>All Africa and worldwide</td>
<td>Information not available</td>
<td>ITU</td>
</tr>
<tr>
<td>AAU</td>
<td>Higher education</td>
<td>CoreVip 1999</td>
<td>All Africa universities</td>
<td>Information not available</td>
<td>AAU</td>
</tr>
<tr>
<td>IDRC</td>
<td>Education Policy Livelihoods</td>
<td>1997</td>
<td>All Africa in general</td>
<td>CAN$60M for 5 years</td>
<td>Acacia Executive Director</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Concentrated in (4) countries</td>
<td></td>
<td>IDRC Regional Officers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NAACs Boarding</td>
</tr>
<tr>
<td>WORLD BANK</td>
<td>Infrastructure Partnership Education</td>
<td>-</td>
<td>All Africa and Worldwide</td>
<td>Information not available</td>
<td>World Bank</td>
</tr>
<tr>
<td>WHO</td>
<td>Health</td>
<td>-</td>
<td>All Africa and Worldwide</td>
<td>Information not available</td>
<td>-</td>
</tr>
<tr>
<td>UNESCO</td>
<td>Policy Education Infrastructure Telecentre</td>
<td>-</td>
<td>All Africa</td>
<td>Information not available</td>
<td>UNESCO Country Office</td>
</tr>
<tr>
<td>SIDA/ SAREC</td>
<td>Education Resource management</td>
<td>-</td>
<td>SK$2-3M per year</td>
<td>Information not available</td>
<td>SIDA</td>
</tr>
<tr>
<td>AFRICA CONNECTION</td>
<td>Infrastructure Policy Telecentre</td>
<td>February 1998</td>
<td>All Africa</td>
<td>Information not available</td>
<td>Steering Committee presently chaired by the South African Minister</td>
</tr>
<tr>
<td></td>
<td>Human resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PICTA</td>
<td>Implementation partners</td>
<td>October 1997</td>
<td>All Africa</td>
<td>Information not available</td>
<td>BellaNet</td>
</tr>
<tr>
<td>USAID</td>
<td>Health Internet access Education Business Infrastructure</td>
<td>-</td>
<td>All Africa</td>
<td>Information not available</td>
<td>USAID Regional Officers</td>
</tr>
<tr>
<td>GKP</td>
<td>Promoting access to and use Empowering poor people increasing partnerships and mutual learning</td>
<td>Emerging from planning and implementing the GK'97 Conference</td>
<td>All Africa</td>
<td>Information not available</td>
<td>GKP</td>
</tr>
<tr>
<td>COMMONWEALTH</td>
<td>Education Telecentre Scholarships for post graduate degrees Health</td>
<td>-</td>
<td>-</td>
<td>Information not available</td>
<td></td>
</tr>
<tr>
<td>SECRETARIAT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNFPA</td>
<td>Decision Support Systems on Humanitarian aid</td>
<td>-</td>
<td>-</td>
<td>Information not available</td>
<td>-</td>
</tr>
<tr>
<td>UNDP</td>
<td>Providing internet access Distance learning Infrastructure</td>
<td>-</td>
<td>All Africa</td>
<td>US$6M (for connectivity)</td>
<td>UNDP</td>
</tr>
<tr>
<td>FAO</td>
<td>Rural Connectivity Internet Connection</td>
<td>-</td>
<td>-</td>
<td>Information not available</td>
<td>UN-FAO</td>
</tr>
<tr>
<td>KELLOG FOUNDATION</td>
<td>Capacity Building - Higher Education</td>
<td>-</td>
<td>Southern Africa</td>
<td>Information not available</td>
<td>Kellogg Foundation</td>
</tr>
<tr>
<td>CARNEGIE FOUNDATION</td>
<td>Higher Education</td>
<td>-</td>
<td>-</td>
<td>Information not available</td>
<td>Carnegie Foundation</td>
</tr>
<tr>
<td>FORD FOUNDATION</td>
<td>Information access and connectivity Dissemination of African Information</td>
<td>-</td>
<td>All Africa</td>
<td>Information not available</td>
<td>Ford Foundation</td>
</tr>
<tr>
<td>GIIC – AFRICA</td>
<td>Policy Infrastructure Education Business Pilot projects</td>
<td>-</td>
<td>All Africa</td>
<td>Information not available</td>
<td>GIIC – Africa</td>
</tr>
</tbody>
</table>

Table 1.3.1 - Recent initiatives for Africa by selected ICT donors and regional institutions [Wild & Sibthorpe1999]
The lack of a physical infrastructure outside the main cities prevents African governments from implementing ICT-based education platforms, applications for cultural, social and economic development, or tele-medicine. Infrastructure programmes would require huge financing, and embarking on IT highway infrastructures would increase Africa's existing debt. Moreover, major reforms in national policies on foreign investment are required to encourage the ICT industry to invest in Africa. The development of network technologies, such as client-server computing and distributed databases, creates additional 'challenges' to the still unsystematic deployment of ICT.

The African Regional Symposium on Telematics for Development, held at United Nations Economic Commission for Africa (UNECA) in Addis Ababa, Ethiopia, in April 1995, was the first systematic effort to address these issues. The symposium resulted in the African Information Society Initiative (AISI), adopted by the ECA Conference of Ministers in May 1996. AISI emphasised the importance of an ICT infrastructure to support decision making at all levels: in government, business and civil sectors of society, and strongly recommended that African nations develop national information and communication policies to encourage the deployment of ICT through the expansion of infrastructure and the development of applications.

In 1999 ECA convened the inaugural session of the African Development Forum on the challenge to Africa of globalisation and the information age. ADF '99 developed an action plan centred on information policy and applications in the areas of education, health and e-commerce. Limited resources and capacity in ECA meant that there was little follow-up on this agenda.

Other constraints to large-scale implementation and use of ICT in Africa are:
- Lack of financial resources for ICT acquisition and maintenance;
- Poor transfer of know-how or little capacity to absorb the ICT;
- Lack of integration of ICT into development strategies and programmes;
- Virtual non-existence of ICT producers;
- Excessive regulation and prohibitive import duties;
- Unwillingness of the ICT industry in the developed word to establish itself in Africa, thereby promoting a dealership-oriented relationship with Africa;
- Limited coverage of ICT in education;
- High level of illiteracy;
- Absence of national ICT policies;
- Little experience with ICT organisation and management;
- Lack of cost-minded approach; and
- The embryonic stage of development of most local and private ICT companies (resellers).

African information management centres are further hampered in their identification of hardware and software suitable for specific information processing activities [http://www3.sn.apc.org/projects.htm] by:
- Scarcity of information on information technology resulting from lack of national policies and instruments to help select the necessary hardware and software;
- Lack of journals and magazines on information technology in African information centres;
- Lack of guidelines on standard hardware configurations required for various types of operations;
- The large variety of hardware on the market; and
- Donor institutions, which impose equipment on recipient institutions without their involvement in the technical choices.

In view of such difficulties, it is not surprising that some members of the development community are doubtful about the usefulness or relevance of ICT in Africa. For example, Mazrui [1978] asks: "In using the computer is Africa enhancing its capacity for development?"
Chapter 1: Exploring the problem area

Is it facilitating the modernisation of management, planning, analysis and administration? Or is Africa adopting instead a technology which is inappropriate to its current needs, expensive, detrimental to job creation, and vulnerable to external exploitation?"

Recognising their common difficulties in the adoption of ICT, African countries are increasingly establishing joint programmes in the area of ICT through their regional forums or in bilateral relations. In particular, collaboration between African countries is seen as an important means of addressing the need for an improved ICT infrastructure [http://www3.sn.apc.org/Africa].

1.3.3 Conclusions

African governments and institutions must compete in a global environment where information is, in theory, equally accessible to all regardless of time and space. There is a growing recognition in Africa of the importance of national information policies/strategies linking academic institutions to broader national information goals.

ICT implementation must be assessed not only in terms of acquisition and use, but also in terms of cultural and social factors. Camara [1990] notes that "African countries have much to learn from the experience of other continents in the development of appropriate policies to address four basic ICT objectives: (1) creating an enabling political and economic environment; (2) initiating the ICT culture with electronic mail capability; (3) targeting specific aspects of ICT for maximum local impact; and (4) integrating education and training programmes for information, computing and communication technologies."

In order to meet these objectives, ICT deployment must be governed by African requirements and ICT projects must be designed with substantial input from African practitioners, although the experience of other developing regions may be relevant. In practice, however, Africa’s ICT needs have largely been determined by Northern actors. Donor agencies have been key to identifying the sectors for which ICT support would be made available and for selecting hardware and software combinations. Systems have often been delivered without concern for long-term sustainability and have not been accompanied by measures to develop and maintain cadres of skilled managers and technicians.

In spite of the opportunities offered by the Internet to equalise access to information and communication channels, Africa as a region is no closer now to taking control of its ICT future than it was in the pre-Internet days. A key weakness is the lack of management capacity and management systems tailored to the local environment, which limits the potential of ICT to deliver development benefit at institutional, countrywide or regional levels.

Africa-wide initiatives on ICT have not borne enough fruit. However, Africa is a diverse continent with 54 countries, and sub-regional mechanisms such as the Common Market for East and Southern Africa (COMESA), the Economic Community for West African States (ECOWAS), and the Southern African Development Community (SADC) are being used to develop frameworks to support the development and dissemination of ICT. In Section 1.4 we look at the Southern African Development Community (SADC) and ICT.

1.4 The Southern African Development Community (SADC) and ICT

1.4.1 SADC

SADC is an economic development community made up of 14 countries in sub-Saharan Africa and the Indian ocean: Angola, Botswana, Democratic Republic of Congo, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe.
Chapter 1- Exploring the problem area

Since its inception in 1981 at the Southern African Development Coordinating Conference (SADCC), SADC has sought to define sectoral development policies and strategies for implementation by member states. To this end, sectoral committees and commissions have been established to guide and co-ordinate regional policies and programmes in specific areas. These commissions were allocated to member states, which provide co-ordination and leadership.

SADC objectives include harmonization of policies and strategies and rationalization of resources in all areas in the community.

In 2001[www.sadc.int] SADC was restructured and in contrast to the country-based coordination sectoral activities and programmes, it adopted a more centralised approach in which its actual 21 co-ordinating units will be clustered in four groups, namely: Trade, Industry, Finance and Investment; Infrastructure and Services; Food, Agriculture, and Natural Resources; Social and Human Development and Special Programmes. The implementation of the new SADC set-up requires the approval of a Regional Indicative Strategic Development Plan. By the time of writing (April 2002) such a plan had not yet been designed and the old structure of SADC was still in place.

The level of ICT activities and projects and use in member states is generally similar to that of the rest of Africa [http://www3.sn.apc.org/projects.htm], with the notable exception of South Africa, which developed considerable industrial autonomy and self-reliance during its political and economic isolation in the Apartheid period. More recently Mauritius became one of the greatest ICT-user countries in the Community. In 1998, SADC had a penetration of 1.97 Personal Computers for 100 inhabitants. In the same period, the world average was 6.43 per 100 inhabitants. The tele-density at SADC in 1998 was 5 fixed lines per 100 inhabitants [SADC2000b]. In the same period, the world average was 14.26 fixed lines per 100 inhabitants.

1.4.2 SADC and ICT

As yet no sectoral commission has been created for ICT as a whole. Telecommunications are dealt with by the Southern Africa Transport and Communications Commission (SATCC), co-ordinated by Mozambique. ICT activities are co-ordinated jointly by SATCC, in Mozambique, and the SADC Secretariat in Botswana.

Attempts to establish a systematic approach to ICT development were made at the SADC seminar in 1996 in Lilongwe, Malawi, and at the subsequent 1999 SADC Consultative Conference held in Lusaka, Zambia, under the title “SADC in the Next Millennium - The Opportunities and Challenges of Information Technology”. These meetings produced valuable material and resolutions on, amongst others, frameworks for standardisation, adoption of protocols, the establishment of regulatory bodies and maintenance and control centres, and a framework for the development of ICT knowledge in the region.

However, implementation of these resolutions has proved problematic, partly for lack of political will, but mainly for lack of national systems to follow up SADC decisions. It is still not clear whether SADC intends to empower SATCC or the SADC secretariat to handle ICT issues, or whether a new sector will be created. Although many ICT projects are being developed throughout SADC, the shortage of management capacity and management systems is hampering the establishment of integrated ICT and a regional market.

An SADC model of telecommunications legislation has been adopted by the majority of member states. The consolidation of the Telecommunications Regulators Association of Southern Africa is a further concrete measure to improve the use of ICT in the region.
Chapter 1- Exploring the problem area

1.4.3 Telecommunications in SADC

The telecommunications sector is of vital importance for connectivity and electronic information transfer. Although there are many strategic activities and projects in progress in SADC in this area (see Table 1.4.1) [SADC1999c], there are no links between the various activities underway, and the telecommunication sector has not developed rapidly. Reasons for this include, among others, low motivation for separation of technical and regulatory functions in each country, and lack of financial and human resources.

The Official SADC Trade, Industry and Investment Review observed that the quality of services of SADC telecommunications networks is “still low by world standards.” While in the developed world, more than 60% of calls are completed, in SADC less that 40% are completed; telephone faults occur frequently (60 and 190 faults per hundred lines), and are not usually quickly corrected, with between 8% and 36% of faults not corrected by the next working week [SADC1999c].

Typically, the telecommunication and technology infrastructure and services suffer from:

- traffic congestion;
- institutional inefficiency of the telecom service providers;
- inadequate maintenance of the telecom systems, including failure to fulfil signed maintenance contracts;
- low level of skills in the workforce;
- diversity of equipment and software in use in each country and in the region;
- lack of common operating standards and procedures among the networks of the region.

<table>
<thead>
<tr>
<th>Telecommunication activities (projects)</th>
<th>Status</th>
<th>Countries involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment of independent regulatory bodies</td>
<td>In progress</td>
<td>8</td>
</tr>
<tr>
<td>Establishment of operators Association (SATA)</td>
<td>In progress</td>
<td>13</td>
</tr>
<tr>
<td>Establishment of Regulators Association (TRASA)</td>
<td>In progress</td>
<td>6</td>
</tr>
<tr>
<td>Separation between telecommunications and postal services</td>
<td>In progress</td>
<td>11</td>
</tr>
<tr>
<td>Liberalisation of the telecommunications industry:</td>
<td>In progress</td>
<td>11</td>
</tr>
<tr>
<td>a) Cellular telephone services licensing</td>
<td>In progress</td>
<td></td>
</tr>
<tr>
<td>b) VSAT licensing</td>
<td>In progress</td>
<td></td>
</tr>
<tr>
<td>c) Supplement basic telephone lines</td>
<td>In progress</td>
<td></td>
</tr>
<tr>
<td>6. Alliances with ‘strategic partners’ to partially privatise their telecom entities</td>
<td>In progress</td>
<td>5</td>
</tr>
<tr>
<td>7. Internet penetration</td>
<td>In progress, More ISPs arising, but mainly serving big cities</td>
<td>14 (all members)</td>
</tr>
<tr>
<td>8. Consolidated telecommunications policy and model for telecommunications legislation</td>
<td>Already developed, awaiting approval</td>
<td>14 (all members)</td>
</tr>
</tbody>
</table>

Table 1.4.1 - Summary of progress in the telecommunications sector of SADC (until 1999)
[http://www.sadcreview.com and SADC2000b]

1.4.4 Conclusions

With the exception of South Africa and Mauritius, the ICT environment in SADC countries is characterised by a weak infrastructure, a multiplicity of equipment and software types and an a very limited research and education base to underpin professional approaches to management. All these factors increase the demands on ICT management.
Chapter 1- Exploring the problem area

On the basis of this conclusion, in Section 1.5 we look at the ICT use and needs in six SADC countries, namely Botswana, Mozambique, Namibia, Swaziland, Tanzania and Zambia. The reasons for selecting these countries are:

- They are neighbouring countries;
- They are broadly similar in terms of socio-economic development but have their own cultural, social and economic specificities;
- The similarities referred to above are not equally visible in all areas of this development. Regarding ICT, for example, there are differences in the extent to which it is used and has penetrated society. Looking at units such as the university computer centres, which serve as a reference, one can see that Mozambique (UEM) and Tanzania (UDSM) are more developed than Zambia (UNZA) and Botswana (UoB), which in their turn are more developed than Swaziland (UNSWA) and Namibia (UNAM). The different stages of ICT use and needs demonstrate the differences between the three groups of countries. With the exception of South Africa and Mauritius, the other SADC countries also fall into these groups.

Therefore the six countries are chosen as being a good reflection of all SADC countries, excluding South Africa and Mauritius.

1.5 ICT use and needs in six SADC countries

Basic information about each country, the level of penetration of telecommunications and ICT developments and facilities are summarized in Table 1.5.1. The general information (date of independence, area, population, literacy, political stability and GNP/capita) illustrates the socio-economic context of the study. Information on levels of penetration of ICT facilities and ICT management provides insight into how the six countries are reacting to ICT deployment, both in terms of ICT use and how the country organizes itself to absorb ICT.

Four of the six countries were colonised by Britain and were granted independence in or before 1966. Mozambique was colonised by Portugal and gained independence in 1975, while Namibia was annexed by South Africa and only achieved independence in 1990. These differences, however, are not reflected in the degree of absorption of ICT.

All six countries have limited skills for and knowledge about ICT development. On average, 28.1% of the population is illiterate, and it is estimated that fewer than 5% of the literate are properly trained to use ICT. The economic situation of the six countries does not allow them to acquire and upgrade technologies and knowledge. Analysis reveals two categories of countries: Mozambique, Zambia and Tanzania, which have a GDP per capita of less than $400, and Botswana, Swaziland and Namibia, which have per-capita GDPs of $1.500-3.300; even so, these are far below those of small countries such as Finland and Netherlands, which have a GDP per capita of 23.780 and 24.320 USD respectively in the World Development Report 2000/2001 [World Bank2000]. There are, increasingly, competing priorities for investment, ranging from building transport infrastructure to HIV-AIDS control. A desire to move into ICT-based development is shown by the number of Internet Service Providers, which has grown from 1 ISP in the six countries in 1995 to more than three in each country in 2000. The number of Internet users in the six countries is estimated at around 40.000, representing 0,06% of the total population in the six countries.

Before independence, in all six countries the main purpose of telecommunications facilities was to provide better links to the colonising country rather than to serve the countries themselves. Thus investments in infrastructures, and consequently businesses and services, were concentrated in the main cities. Today these businesses and services increasingly require a telecommunication infrastructure.

Mobile phones were introduced around 1998 in all six countries. The rapid increase in the number of mobile phones in a short period shows the demand for telecommunication infrastructures for both data and voice transmission.
<table>
<thead>
<tr>
<th>Country</th>
<th>Independence</th>
<th>Area (km²)</th>
<th>Population (mn. 1999)</th>
<th>Illiteracy (Aged 15+)</th>
<th>Political stability</th>
<th>GNP per Capita (USD)</th>
<th>ICT penetration</th>
<th>IT management</th>
<th>Availability of ICT co-ordination units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MZ</td>
<td>1975</td>
<td>799,390</td>
<td>18.12</td>
<td>60.5%</td>
<td>Stable</td>
<td>210 (1998)</td>
<td>75,000+ with 0.64% penetration and 99% digitised circuits with high concentration in urban areas</td>
<td>CIUDEM, Emil, TDM, Teledata, Tropicatel, Vircon. +10,000 Internet users</td>
<td>35,000 in year 2000 roaming with more than 20 countries</td>
</tr>
<tr>
<td>ZAM</td>
<td>1964</td>
<td>753,300</td>
<td>11.60</td>
<td>30%</td>
<td>Stable</td>
<td>365</td>
<td>+9,500 with 1.1% penetration and 85% digitised circuits</td>
<td>Zamnet, Coopernet, Zamtel. Estimated 4,500 internet users by 2000</td>
<td>5,400 in year 2000</td>
</tr>
<tr>
<td>BOT</td>
<td>1966</td>
<td>56,200</td>
<td>1.65</td>
<td>26%</td>
<td>Stable</td>
<td>3300 (1988)</td>
<td>+100,000 with 6.4% penetration and 100% digitised circuits</td>
<td>Botsnet, BTC, Mega-Internet, Infobotsware, Global Internet Access, InterTswana, 4sale + 7,000 internet users</td>
<td>15,500 in 2000 roaming with more than 20 countries</td>
</tr>
<tr>
<td>TAN</td>
<td>1960</td>
<td>94,500</td>
<td>33.00</td>
<td>30%</td>
<td>Stable</td>
<td>218</td>
<td>+150,000 with 0.4% penetration and digitized/analogue circuits</td>
<td>SITA, Wilken/Afusat, Datel, USDM, CyberTwiga, TTCL, RahaOnline, CATS, AfricaOnline, Heartbeat Online, Internet Africa</td>
<td>+31,000 in year 2000</td>
</tr>
<tr>
<td>NAM</td>
<td>1990</td>
<td>824,000</td>
<td>1.65</td>
<td>20%</td>
<td>Stable</td>
<td>1,575 (1998)</td>
<td>+11,500 with 6.2% penetration and 100% digitized circuits</td>
<td>Namibnet, INWN, Club Internet, Web Metropolis.com UUNet, Africa Online. +5,000 Internet users</td>
<td>Roaming with more than 20 countries</td>
</tr>
<tr>
<td>SWA</td>
<td>1968</td>
<td>17,400</td>
<td>0.96</td>
<td>22%</td>
<td>Stable</td>
<td>222 (1998)</td>
<td>+32,000 with 3.6% penetration and digitized/analogue circuits</td>
<td>Africa Online, Real Image +1,200 dial-up users</td>
<td>Roaming with two countries</td>
</tr>
</tbody>
</table>

Table 1.5.1 - Synopsis of the six countries [UNDP1998; BMI2000; World Bank2000 and CPINFO2000]
Chapter 1 - Exploring the problem area

With liberalization of the economies in all six countries, the number of small and medium-sized enterprises is growing, and their use of ICT is increasing. However, the local ICT industry is made up of dealers and suppliers rather than producers. In all six countries, all the major brand names and types of ICT can be found, ranging from PCs and laptops to mini and microcomputers, with Windows and UNIX as the most common operating system for this type of hardware. Many brands of communications infrastructure equipment can also be found in all six countries.

Management of ICT is still not identified as a distinct professional activity. Very few people understand the concepts involved in ICT management (e.g. incident management, problem management, change management and managing the acquisition process) and, as a rule public and private organizations and consumers just “buy and use”. There are few research or teaching bodies that deal with ICT management issues. Within the government there may be more than one ministry responsible for ICT issues. On the one hand there is a widening of knowledge on ICT, while on the other hand there is a lack of research, analysis, organization and coordination.

Nevertheless, all six countries are taking steps towards the development of national information policies, suggesting recognition of the need for a national body responsible for ICT development. In Mozambique, Namibia and Tanzania, university staff have been involved in the formulation of national policies, thus showing the governments’ vision of the universities’ role in knowledge-based development. Indeed, in countries with a severe shortage of technical knowledge and capacities, the expertise, knowledge and experience contained in the universities represent important resources that can be harnessed in the cause of national development.

The six countries face the same problems of external influence on ICT acquisition as the African region as a whole. However, the framework of resolutions created by SADC, even if not fully implemented, and the interest in all six countries in developing their own national ICT strategies mean that there is a foundation for collaboration and information exchange among them that could lead to concerted action to strengthen their negotiating position with external donors and manufacturers.

**Conclusions**

With political stability, the six countries are increasingly implementing socio-economic development programmes, alongside many ICT initiatives. ICT strategies are being developed in the six countries but management of ICT is still not identified as a professional activity.

In the context of this conclusion, in Section 1.6 we identify the issues, which constrain effective management and use of ICT in the six universities in the six countries.

**1.6 Issues in ICT Management in six universities in the six countries**

**1.6.1 The six universities**

The six universities are: University of Botswana (UoB) in Botswana, University of Dar Es Salaam (UDSM) in Tanzania, University Eduardo Mondlane (UEM) in Mozambique, University of Namibia (UNAM) in Namibia, University of Swaziland (UNISWA) in Swaziland, and University of Zambia (UNZA) in Zambia.

**1.6.2 Issues in ICT Management in six universities**

These universities are dependent on ICT for fulfilment of their mission. Although they possess ICT, they face the same kinds of problems as their countries in general. In particular, they are confronted by a lack of knowledge, not only about how to use ICT but also about how to manage it.
Table 1.6.1 shows that all six universities were established during the last 40 years. By comparison, TUDelft in the Netherlands is 150 years old and the University of Cambridge in the UK is about 700 years old.

Student numbers range from about 3700 at UNISWA to over 10800 at UoB. The numbers of academic (teaching and research) and administrative staff range from about 400 in UNISWA to 1677 in UDSM, and support staff range from 216 at UNAM to 903 at UEM. The ratio of administrative and support staff to academic staff is very high at about 2:1. As these universities are public institutions, governed by public-sector norms, once staff are admitted they cannot easily be dismissed, even if they prove not to have the skills needed for their specific post. In general terms the main mission of these universities is to serve as knowledge centres for education and research, dedicated to “producing” the human resources necessary for the development of their countries and contributing through research to global knowledge. Before they can achieve this, however, they need to build the knowledge they need for their own functioning. In some areas, such as ICT, such knowledge is scarce. The six universities are faced with the need to build the skills and knowledge required for a more efficient and effective utilization of the technologies available.

All six universities belong to the public sector. With a shortfall in public financing, they are forced to find alternative ways of mobilizing financial resources, through donors and other external funding. As an illustration of this shortfall, UEM’s real needs for 2001 were 55.6 million USD, while the total funds made available from the national budget were 26.86 million USD. For 2002, UEM’s needs were 57.77 million USD and the available funds were 28.60 million USD.

At the same time, they are undergoing internal reforms, often as part of national public-sector institutional reform programmes. They are thus faced with making choices on strategic issues in university management, such as centralisation versus decentralisation, and on priorities for allocation of available financial resources. Table 1.6.1 provides information on the penetration of ICT in the universities. ICT is becoming ever more important. It is used for automated administrative services such as payroll, student registration and library systems. ICT are introduced in the curricula as tools, such as statistical packages, word processing and spreadsheets. Academic and administrative staff and students increasingly use the Internet, for which all six universities have a very limited bandwidth for access. All six universities have developed their own web sites.

Although all six universities have up-to-date telephone systems (PABX and phone sets), cabling tends to be old and there are frequent breakdowns and interferences, as well as in some cases unstable power supplies. With the exception of UoB, all the universities are dispersed over more than one campus. The voice telecommunication networks between campuses, in some cases used also for data communication, are provided by the national telephone companies of the respective countries, all of which hold monopolies for fixed/land lines. Thus the universities are confronted with very high telecommunications bills for local, regional and international calls including data transmission and Internet. Few private-sector operators are active in this area, and there has been little investment to improve the telecommunications infrastructure.

The main brands of computer hardware (mainly PCs) can be found in the six universities, which generally have a very diverse range of hardware and software, often acquired on a “project-by-project basis” from a variety of donor agencies which influence the ICT acquisition process. Application software is either developed in-house or acquired from suppliers.

In an increasingly competitive market, with many products serving the same purpose and many suppliers with different methods of penetrating organizations, the six universities are also faced with issues relating to acquisition: selecting appropriate suppliers, managing
contracts signed with them and securing proper delivery of the acquired goods. They also face
issues related to inadequate service levels provided by suppliers’ after-sales services.

<table>
<thead>
<tr>
<th>University</th>
<th>Country</th>
<th>Capital where located</th>
<th>Established</th>
<th>Student Population</th>
<th>Academic / Admin. Staff</th>
<th>Support Staff</th>
<th>Level of penetration within the six universities</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNZA</td>
<td>Zambia</td>
<td>Lusaka</td>
<td>1964</td>
<td>4544</td>
<td>1422</td>
<td>516</td>
<td>a) Limited b) Available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- In-house development - From suppliers and vendors - Various types of application software</td>
</tr>
<tr>
<td>UNISWA</td>
<td>Swaziland</td>
<td>Mbabane</td>
<td>1972</td>
<td>3726</td>
<td>403</td>
<td>406</td>
<td>a) Limited b) Available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- In-house development - From suppliers and vendors - Various types of application software</td>
</tr>
<tr>
<td>UNAM</td>
<td>Namibia</td>
<td>Windhoek</td>
<td>1963</td>
<td>5148</td>
<td>600</td>
<td>216</td>
<td>a) Limited b) Available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- In-house development - From suppliers and vendors - Various types of application software</td>
</tr>
<tr>
<td>UEM</td>
<td>Mozambique</td>
<td>Maputo</td>
<td>1982</td>
<td>7393</td>
<td>562</td>
<td>503</td>
<td>a) Limited b) Available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- In-house development - From suppliers and vendors - Various types of application software</td>
</tr>
<tr>
<td>UDGM</td>
<td>Tanzania</td>
<td>Dar Es Salaam</td>
<td>1961</td>
<td>7089</td>
<td>1677</td>
<td>357</td>
<td>a) Limited b) Available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- In-house development - From suppliers and vendors - Various types of application software</td>
</tr>
<tr>
<td>UB</td>
<td>Botswana</td>
<td>Gaborone</td>
<td>1964</td>
<td>16526</td>
<td>2306</td>
<td>1547</td>
<td>a) Limited b) Available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- In-house development - From suppliers and vendors - Various types of application software</td>
</tr>
</tbody>
</table>

Table 1.6.1 General data and selected indicators of ICT penetration in the six universities

Potential users are not adequately trained in the proper use of ICT products and equipment, and they are not sufficiently equipped with knowledge of how to relate properly to ICT management and maintenance. In an environment of financial shortage, cost consciousness should also be developed among the users, though this is not always the case. The six universities are faced with low levels of schooling among administrative and technical staff.

### 1.6.3 Conclusions

The six African universities operate in an environment of scarce human and financial resources, where management systems and capacities and a project management approach are crucial for exploiting the benefits that ICT can provide, both in their own operations (teaching-learning, research, services, and university management and administration) and also to support ICT policy development and implementation in their respective countries, to equip future generations with relevant ICT understanding and skills.
Chapter 1 - Exploring the problem area

On the basis of this conclusion, in the next section we define the problem area and the research proposition.

1.7 The problem area and the research proposition

1.7.1 Defining the problem area

In the foregoing exploration we have shown that the context in which African universities operate demands a more systematic approach to the management of ICT to support research, education and administrative functions in an increasingly network-based global environment. We have also identified many issues associated with ICT which is brought to Africa in general, and to African universities in particular.

Issues of a strategic nature are: ICT security, centralization /decentralization of ICT, education and building knowledge on ICT and mobilisation of financial resources. We aggregate these issues in one object related to ICT management and we designate the object as ICT strategy.

Issues related to the acquisition of ICT, such as selection, costs, delivery of ICT and decisions on whether the university should develop its own information systems or acquire them from suppliers (in-house development versus acquisition from outside) are aggregated in one object related to ICT management, which we designate as ICT development/acquisition.

Issues related to the implementation of ICT, such as installation of ICT, project management, agreements on levels of ICT services to be provided by suppliers and training programmes for the user organization are aggregated in one object related to ICT management, which we designate as ICT implementation.

Issues related to the utilization of ICT, such as providing users (academic staff, administrative staff and students) with an understanding what ICT is being used, making sure that the ICT in use is used efficiently and effectively, user behaviour, cost consciousness and interaction of users with services providers are aggregated in one object related to ICT management, designated as ICT utilization.

Issues related to the management of services, such as relevant management processes and qualifying aspects of services management are aggregated in one object related to ICT management, designated as ICT services management.

Although other objects could be designated, we consider that ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT services management constitute the main problem area, and are therefore our focus for in-depth explorations.

1.7.2 The research proposition

On the basis of our defined problem area, we formulate the following research proposition:

Universities need awareness, knowledge and skills concerning the application of ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT service management.

The proposition will be justified by means of a workshop followed by intensive assessments.
Chapter 2 – Research Approach

2. RESEARCH APPROACH

2.1 Introduction

In this chapter, we present the methodology used in carrying out our research study. In this methodology we systematically outline detailed steps that will be followed during the different stages of the research process, as formulated by Yin [1994]. In order to critically think through each stage of the research process, as recommended by Benbasat, Goldstein and Mead [1987], in the methodology we reflect a number of important decisions made sequentially by evaluating the relative desirability of each of several research approaches.

The sources of raw data used for this research are documentation, interviews, direct observations and participants’ observations. A chain of evidence was established during data collection [Denzin1994]. This involved maintaining a database of all collected data in a logical and coherent flow so as to facilitate the synthesis of the data into evidence for analysis. This will include a literature review to confront formulated ideas and the use of case studies to confront similarities in theories [Eisenhardt1989].

2.2 Research Methodology

The methodology is made up of a set of nine interrelated steps that all have to be carried out in order to conduct the research study. The first step also encompasses a sequence of five sub-steps, representing the five sections of Chapter 1.

Step 1  Step 1 is a literature review (exploration 0), in which sub-steps 1 to 5 are undertaken aiming to the exploration of the problem area:

Sub-step 1: ICT in developed countries, summarising aspects such as ICT industry, ICT suppliers, education, and forums for dissemination (Section 1.2).

Sub-step 2: Infiltration of ICT into Africa, covering the role of the developed world and international donors in transferring ICT to Africa, the impact of this infiltration and the constraints on effective ICT use (Section 1.3).

Sub-step 3: ICT in the Southern Africa Development Community (SADC), in which we define SADC and review progress in the development and implementation of ICT policies and strategies within the organisation (Section 1.4).

Sub-step 4: ICT in six countries of SADC (Botswana, Mozambique, Namibia, Swaziland, Tanzania, and Zambia), outlining the current state of ICT development and use of ICT in business, education, government, research, and industry (Section 1.5).

Sub-step 5: ICT in six universities in the SADC region (Universities of Botswana, Namibia, Swaziland, Zambia, Dar Es Salaam [Tanzania] and Eduardo Mondlane [Mozambique]), identifying the issues that constrain effective management and use of ICT (Section 1.6).

After sub-steps 1 to 5 the problem area is determined, which in its turn leads to the formulation of the Research Proposition, presented at the end of Chapter 1 (Section 1.7).

Step 2  Step 2 uses a workshop to develop Exploration 1. Its main objective is to qualify the research proposition identified in Chapter 1 through interaction with senior university participants. The workshop serves to bring ICT management issues to the attention of the top management of the universities.
While the literature review, case studies, fieldwork and data gathering are normal research methodologies [Yin1994], in our methodology we also introduced an innovative approach: a workshop for the top management of the six universities. The workshop took place in Maputo, Mozambique, and was attended by the Rectors, Vice-Rectors and Directors of Computer Centres of the six universities (Chapter 3).

Step 3 In Step 3 we present a summary of three models, based on the ones elaborated in Looijen [1998]. The models are: MCM paradigm, State model/Extended State Model and Triple model of MCM. These models are proven to apply to ICT management assessments in a number of research projects. A number of subjects and objects derived from the models have to be assessed in order to obtain information about the present situation concerning ICT strategy, ICT development/ acquisition, ICT implementation, ICT utilization, ICT service management (Chapter 4).

Step 4 Step 4 is Exploration 2, made up of the case studies (assessments) of the six universities, with the aim of gathering information on the present situation of the Big ICT Five by focusing on a number of subjects and objects which belong explicitly or implicitly to the MCM paradigm, State model/Extended State Model, and Triple model of MCM (Chapters 5 to 10).

Step 5 Step 5 is the design of a conceptual model. The design will be supported by the data collected in the two explorations (1 & 2). The conceptual model is based on the five major aspects given in the proposition presented in Chapter 1, namely: ICT strategy; ICT development/acquisition; ICT implementation; ICT utilization; and ICT service management (Chapter 11).

Step 6 Step 6 is system realization, in which an integrated management information system is produced by applying object-oriented system analysis. The system realization is intended to support the conceptual model designed in step 5 (Chapter 12).

Step 7 Step 7 is the validation of the assessments made in the six universities, the conceptual model and the automated, integrated management information system. The validation is undertaken by testing or applying them in the six universities assessed (Chapter 13).

Step 8 Step 8 is the presentation of the Epilogue, which outlines the summary of the research done, the author's experience in this research and the formulation of further research by presenting an agenda for five research projects based on the research work done (Chapter 14).

The research methodology described in Section 2.2 is presented in Figure 2.2.1.
Chapter 2 – Research Approach

Exploration 0

Step 1 ➔ Chapter 1 [Exploring a problem area]

Step 2 ➔ Chapter 2 [Research Approach]

Step 3 ➔ Chapter 3 [Research Proposition]

Step 4 ➔ Chapters 5-10 [Assessment of the six universities]

Models

Step 3 ➔ Chapter 4 [Presenting Applicable Models]

Exploration 1 - The workshop

Yes

The Conceptual Model

Step 5 ➔ Chapter 11 [Developing the Big ICT five Conceptual Model]

The Automated System

Step 6 ➔ Chapter 12 [System realization]

Testing the system in n Universities

Is n = 6?

Yes

No

Is the System responsive?

Adjusting the model, according to the outcome of the Validation

Epilogue

Step 7 ➔ Chapter 13 [Validation of the System in the six universities]

No

Step 8 ➔ Chapter 14 [Epilogue]

Figure 2.2.1 - The Research Methodology
3. RESEARCH PROPOSITION

This chapter presents Exploration 1, carried out through a workshop for senior university officials. The objective of this exploration was to secure the agreement of the universities to support the assessments to be made concerning their ICT strategy, ICT acquisition, ICT implementation, ICT utilisation and ICT service management, as stated in our proposition. The assessments will serve as case studies in the research project.

3.1 Introduction

The exploration, carried out through a workshop held in Maputo on March 25, 2000, was the culmination of a long process of interaction between the researcher and the selected universities. Contacts with UDSM in the ICT field exist since the beginning of the 1990s. With other universities, contacts were established in the middle of the 1990s.

The interaction process included field visits and participation in conferences as well as exchange of correspondence. The workshop provided an opportunity to review and discuss the proposition at the centre of this research and the problem of ICT management in general; it thus contributed to the building of a common knowledge base on ICT management in universities in Southern Africa.

Senior management staff of the universities agreed to participate in the workshop because the subject of ICT management extends far beyond technological issues and impacts on organizational, leadership and decision-making processes.

Each of the universities was asked to bring to the workshop information on the nature and stage of development of ICT in their institution, the organizational structure that supports ICT management, and the ICT management instruments in use.

The workshop was attended by Rectors, Vice-Rectors and Directors of Computer Centres of the following universities: University of Zambia (UNZA), University of Swaziland (UNISWA), Eduardo Mondlane University (UEM), University of Botswana (UoB), University of Dar Es Salaam (UDSM), University of Namibia (UNAM). These six universities have been selected for our research. The Open University of Tanzania was also represented as an observer. TUDelft and UEM designed the scientific content of the workshop.

Bringing such dignitaries to a one-day workshop was not an easy task and it required considerable preparatory work. We had to explain the reason for the workshop. We had to provide means to the majority of participants to travel and to be accommodated in Maputo. Arranging to get somewhere by plane in Africa is very difficult and in some unforeseen cases all arrangements had to be made by us. In many cases communication by telephone or fax was impossible. E-mail was extensively used to make all arrangements. All participants were present at the start of the workshop. All this preparatory work was done to lay the foundation for obtaining the agreement of all universities participating in the workshop to allow the case studies necessary to the research work. The workshop was realised and results were satisfactory, as we will see later on in the recommendations and conclusions.

3.2 Workshop objective

ICT penetrates all the development areas of the universities, and the complexity and cost of ICT have brought us to a situation where ever more research is needed in order to achieve better integration of ICT into the universities' development strategies.

The general objective of the workshop was to provide an opportunity for debate and an interchange of experiences in the area of management and control of ICT in the universities in
Chapter 3 - Research Proposition

the region. It aimed to promote discussion with a view to building a common body of thought on ICT deployment, management and control in higher-education institutions in Africa.

The specific objective was to explore the validity of the proposition by:

- introducing university managers to the strategic position of ICT within their universities – workshop session 1;

- exploring the methods or techniques which could support management of the five key aspects of our research (the big ICT five) and creating a common theoretical understanding – workshop session 2;

- building a common knowledge base on the existing situation in universities in the region – workshop session 3;

- demonstrating and building recognition of the importance of ICT strategy, acquisition, implementation, utilization and service management as key ICT management areas in universities – workshop session 4;

- securing the agreement of the universities on the research area and research proposition – workshop session 5.

3.3 Workshop participants and programme

3.3.1 Workshop Participants

The participants at the Workshop on Management and Control of ICT in Institutions of Higher Education (IHE) in Southern Africa, for the exploration 2, were drawn from the top management of universities in the region. The list of participants is shown in Annex 1.

3.3.2 The Workshop Programme

The Workshop Programme was made up of 5 main sessions. The diagram shows how the subject of the workshop was gradually ‘funnelled down’ to the validation of the research proposition and the contribution to development of improved theories, by involving those who are making decisions on ICT in the universities. The workshop was intended to provide feedback to the research and thus to improve its results. It would also serve to bring ICT issues to the attention of the top management of the universities.
Session 1: Presentation of the context of the work to be developed during the workshop, and its objectives.
Session 2: Establishment of a common scientific base, in terms of the scope, terminology and concepts of the work to be developed during the workshop.
Session 3: Presentations on the situation in the participating universities in relation to ICT development.
Session 4: Presentation of five key questions relating to the management of ICT, debate and validation.
Session 5: Final debate including main conclusions and recommendations, followed by the closing speeches.

3.4 The workshop proceedings

3.4.1 Session 1: The context and objectives of the workshop

The senior level of the participants indicated the interest in and the importance being given to the subject of ICT in African universities. Although there is much activity in this area, ICT is not yet well understood in terms of its strategic position within the universities, its added value and its organizational and budgetary implications. In this context, this research work seeks to identify the critical elements associated with the deployment, use and management of ICT and the need to develop a management tool to support ICT management processes in African universities.

3.4.2 Session 2: Establishment of a common scientific base

In view of the discrepancies and variations in the knowledge and the working habits of the participants in the workshop in relation to ICT development, the objective was to provide the participants with an adequate understanding of the elements contained in the research proposition, so that they could participate in the debate in sessions 4 and 5.

The session covered the following elements as a conceptual basis for understanding them at university level, and analysing and managing them:

**Project cohesion** The universities under study receive ICT from an external market, and they must take this into account in their decision-making on ICT. Moreover, they are all to a greater or lesser extent dependent on donor funds, and the donors take advantage of this situation to introduce ICT without the full participation of the universities in the relevant decisions. However, in a global economy in which the division and specialization of labour is essential, it is important that ICT management is not constrained by the acquisition of products offered by outside agents. Rather, the universities should provide incentives and serve as pioneers in the development of ICT.
Chapter 3 - Research Proposition

A managerial step-by-step plan This should be prepared on the basis of a broad view of ICT, including hardware, software, human resources, planning, procedures and external factors. Although issues related to hardware, software and human resources may predominate, scientific standards should enable the development of appropriate concepts for ICT management.

The following observations can be made about university high-level managers:

- Since they have the most knowledge about the university structure, and since they make the main decisions, it would be expected that they would be more critical about the university’s management of ICT.
- They are responsible for the development of all areas of university activities, taking into account the specific functions attributed to each department. The question is: do they possess adequate tools for ICT management to help them assess through their information systems whether the ICT that has been acquired responds to the specific needs of each area.
- The information systems being used must take account of the nature of a university institution. Although there are some generally applicable issues in ICT management, in practice most issues concern specific elements of individual systems. For example, ICT management for a university can ignore many of the aspects which a profit-seeking commercial enterprise would have to consider, but must give special attention to other aspects such as the type and quality of human resources, competition among similar institutions, flux and fluidity of the availability of financial resources.

The MCM paradigm (see also Chapter 4) This entails the management, control and maintenance of information systems in accordance with the requirements and preconditions imposed by the utilization, the situational factors and the characteristics of the information system components (hardware, software, databases, procedures and people). It takes into account the external influences, such as level of education in the country, suppliers, economy, management, and donors.

The MCM paradigm offers services in the most effective and efficient way. Once applied in each university, it provides an approximate picture of the state of the ICT in that university. It influences the goals of the organization in a positive way.

Network Structure This is the technological complex of ICT that enables the processing, exchange, custody and storage of the information belonging to one or more units of the organisation. This information constitutes one of the main assets of the organisation.

The sharing of the Network Structure constitutes another important element in ICT management, as a result of the ever-increasing tendency to establish a mixture of ICT network structures. To set up such structures, one must answer many questions, including:

- What elements make up the network? This depends on geographical aspects of the network distribution and the ICT elements which form the network: whether it is a Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Network (WAN), Internet, etc.
- How should the network be managed? This will depend on whether the network belongs entirely to the university or whether the university also depends on external bodies for the operation of its network. These bodies may include telecommunications companies, Internet Service Providers, etc.
- Why must the network be managed? The network structure is made up of components of ICT at different levels that must be managed according to the MCM paradigm.

ICT complexity The ICT complexity is determined by nine factors, namely:

- **quantity**: number of ICT resources and network components
- **diversity**: the types of ICT components
Chapter 3 - Research Proposition

- distribution: degree of decentralization of ICT within university campuses
- dynamics: regularity with which changes are made to the ICT components
- functionality: variety of functions with regard to ICT
- relationship: procedures governing relations in relation to ICT
- ownership: whether ICT resources belong to one or various owners
- utilisation: degree of different demands and preconditions for use
- sophistication: the degree of advancement and the possibilities to influence existing software in a positive or negative way.

Each of these elements has associated processes and procedures, and they are interrelated at various levels, thus creating the complexity. The analysis of these nine factors defines the complexity of the ICT management.

**ICT management** The point of departure is always the determination of where our university is in relation to ICT development. This process of determination should serve as self-criticism and self-assessment, based on standard assumptions of ICT management. For scientific management of ICT, prior analysis of the factors of complexity is fundamental. As well as these theoretical-analysis factors, objective factors such as the capacity and work experience of the human resources available must be analysed. Once the results of this analysis are known, it is possible to move on to a scientific ICT management.

**The competence diagram** This describes the distribution of competence within the management structure of the organization. It should be noted that processes and procedures are negatively affected when they are associated with an irregular or irrational distribution of competence. Thus, even before an effective degree of performance of the functions assigned to each level of competence is reached, it is essential that competence be efficaciously distributed. The Competence Diagram is a necessary tool with an important role in ICT management.

**The life cycle of ICT** This is a comprehensive process involving all the components of the system. This process is made up of the following states: information policy and information planning, information system development, information system acceptance and implementation, information system utilization, information system exploitation and information system maintenance. Within the university, these phases should be seen in the light of the needs and the capacity of the institution. The management of the university must take a stance regarding the implementation of changes in the information system, the crucial element of the ICT life cycle.

Categories of ICT management can be differentiated as:
- functional management
- application management
- technical management

These three functions constitute the foundations of ICT management, and should be analysed jointly with the Competence Diagram. Responsibility for all three functions must not be concentrated in one individual, since this would put the university in a position of dependency and thus put it at risk, with all the consequences ensuing from such a situation. Each function should therefore be allocated to a different person, respecting the Competence Diagram.

**The ICT (Services) Centre** is responsible for correct formulation of Service Level Agreements (SLAs). This ensures that the activities of the centre are in conformance with the SLAs. This dual MCM relation can be realised in two forms:
- Service Level Agreements established between the ICT service centre and the ICT end users.
- Service Level Agreements established between the ICT service centre and the ICT suppliers.
Chapter 3 - Research Proposition

SLAs are made up of the following elements:

- a written undertaking from the parties involved in the SLAs;
- the explicit purpose of the agreement;
- the description of the services required to be supplied;
- the administration of the process of implementing the agreement;
- necessary annexes.

Once SLAs have been established, the relationship between the parties will be based solely of
the content of the agreement, in terms of the duties and rights of each party in respect to the
maintenance of a specified level of ICT service.

Questions from participants Following the presentation, two questions were raised by the
participants:

i. Is it possible to identify tools for ICT management?
ii. How can priorities for ICT management be defined?

The questions were answered as follows.

i. In order to identify tools for ICT management, it is important to:
   - understand what ICT exists within the university;
   - understand the requirements imposed on the ICT;
   - understand what is possible to achieve with these requirements in relation to
     the existing ICT;
   - apply the MCM paradigm to assess the present situation and after that to set up
     a new desired situation. The new situation has to reflect what is needed and
     appropriate techniques have to be applied to achieve the new situation.

ii. The definition of priorities is a responsibility of the top management of the
    university. It cannot be relegated to the university ICT services centre. To define
    priorities, it is important to understand the requirements imposed on ICT by the
    Real System (i.e. the university). This is the responsibility of top management in
    association with ICT management.

3.4.3 Session 3: Presentations by the participating universities

This session was intended to build a common knowledge base among participants on the ICT
situation in the six universities.

The following issues were raised:

- All universities face the challenge of acquiring ICT to support the development of
  the full range of their activities. The universities have different histories and
  experiences with ICT.
- The introduction of ICT in the universities is not uniformly paced. In all the
  universities the administrative services (mainly finance and payroll information
  systems) are being automated, with various different technical solutions. They all
  have computer laboratories for teaching staff and students. They all have
  connections to e-mail and most have connections to the Internet.
- All complain of scarce financial and human resources for ICT development. They
  depend on government budgets and donors.
- All the universities, in their development plans or strategic plans, are planning to
  introduce ICT for all areas of activity. There is thus great interest in finding the best
  way to develop ICT, and to manage it effectively.
- There is great diversity in ICT among the universities represented at the workshop,
  and the ICT is installed in dispersed sites, creating maintenance difficulties. In
  general, the universities do not have policies for standardizing ICT or guidelines for
  the acquisition of ICT.
Chapter 3 - Research Proposition

- Managers, users and technicians have different views on ICT management, particularly in terms of the relations and services which each level should provide to the others. The users consider the ICT managers to be uncommunicative and arrogant. On the other hand, the managers and technicians consider the users to be unable to present their problems clearly. All the universities wish to overcome these problems.
- UEM and UDSM already have Informatics policies.

3.4.4 Session 4: The five key ICT management components and proposition acceptance

The intention of sessions 2 and 3 was to harmonise the scientific understanding of the participants and create a basis for analysis of the most important aspects of ICT management. This session 4 had as its objective securing the agreement of the participants to the essential characteristics of the five components identified in the proposition given in Chapter 1, which states:

Universities need awareness, knowledge and skills concerning the application of ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT service management.

We have chosen to call these ICT aspects The BIG ICT FIVE. At the workshop they were presented as follows:

ICT strategy. An ICT strategy is the means through which the university allocates resources to ICT applications in different functional areas and to the overall needs of the institution. The universities must develop realistic ICT strategies that take account of the African context and the processes of teaching-learning, research and administration in Africa. Thus, the universities must seek to answer the following questions:

i. What can be realistically included in the ICT strategy?
ii. How can this strategy be formalised?
iii. What does it take to make such a strategy a success?

Before Question 1 above can be answered, one must understand what is meant by the term “realistic”. In order to understand what could be realistic and possible to implement in the medium term, one must understand the existing situation and the university’s objectives and determine what must be done in order to achieve these objectives. It is also important to understand the real situation of the country where the university is located. In this process, it is important that the universities consider not only the resources which they currently possess but also the possibility of mobilizing the resources necessary for achieving their priority objectives, determined using instruments such as a Strengths, Weaknesses, Opportunities and Threats analysis (SWOT).

The answer to Question 2 must take into account that, once the strategy is formulated, the members of the organization must comply with it and contribute to its implementation. The formalisation of the strategy guarantees the support of decision makers and implementers at various levels within the university. It is therefore essential that the need for the strategy is clearly explained, and that the strategy enshrines the involvement of the decision makers. For example, the establishment of Internet services in the university must involve the Rector and Vice Rectors, Deans of Faculty, Technicians, Administrators, as well as the Users/Beneficiaries.

With regard to Question 3, the full potential of ICT will only be exploited to the maximum when users in functional areas are totally convinced of the value of ICT for teaching, research and university administration.
Conclusion: The ICT strategy must be a dynamic on-going process, because in the process of implementation, new strategic elements (university objectives, new programs) may arise and need to be incorporated into the initial strategy.

**ICT acquisition** refers to obtaining ICT for the universities, either by purchase by the universities themselves, or by donation. It includes the acquisition of hardware, software and communication facilities.

Correct acquisition of ICT requires a full understanding of the university’s needs, including:
- an understanding of the availability of materials and financial and human resources;
- an understanding of the consequences of ICT acquisition; and
- critical knowledge of the suppliers and ICT products.

An acquisition strategy should safeguard the following:
- application of correct procedures, and
- acquisition decisions by appropriate people.

Procurement constitutes an administrative process within acquisition, in which it is possible to choose from a wide range of products through negotiations between the interested parties. However, the connection between procurement and acquisition of ICT in African universities is not always straightforward. Procurement is associated with purchase, and implies an active process on the part of the universities, whereas acquisition may contain active elements (procurement) and passive elements (donation). In reality the African universities acquire most of their ICT through donation and have little scope for procurement.

Conclusion: The establishment of a university ICT acquisition system that applies to both purchases and donations could ensure the standardization of equipment and systems within the universities and lead to cost savings.

**ICT implementation** should be based on project management methods that incorporate both organizational and technical aspects.

The technical part of a system can easily be implemented, maybe within a few weeks’ work. However, the organizational implementation is slow and is the most complicated aspect of implementation. For example, at UEM the substitution of the academic records system and the administrative database have been in progress for the last two years.

Conclusion: Technical, economic, personnel and organizational elements must be considered when one selects a project management system to ensure that it is compatible with the level of complexity that the university can absorb.

**ICT utilization.** The successful utilization of ICT requires qualified ICT users and well-defined service level agreements.

The training of users is an important element of the successful implementation of an ICT project since trained users reduce the problems presented to the help desk; as users learn that they can solve problems, their confidence increases and they become effective allies of ICT managers.

Conclusion: African universities need to invest in training ICT users.

**ICT service management.** The management of ICT services must be based on well-defined user requirements, management commitments and agreed expectations on inputs and outputs.

Different departments of the university have specific responsibilities for their own systems and the functionality of these systems.
Chapter 3 - Research Proposition

Clear definition of the division of responsibilities between the central ICT unit and the departments facilitates effective overall ICT management. This must take account of two levels of management of ICT:

- The greater sphere – which involves the totality of the so-called Big ICT Five.
- The lesser sphere – which involves each individual element of the Big ICT Five.

For the effective implementation of ICT management, action should be taken in both these spheres.

3.5 Conclusions and Recommendations

The objective of the workshop was to secure the agreement of the universities to participate in the assessments required for the case study input into the research. Agreement in this area would presuppose at least a preliminary interest in applying the results of the research surrounding the proposition articulated in Chapter 1.

In the final session, there was a debate [Yin1994] on the presentations and on the proposition indicated in Chapter 1. This debate led the participants to the conclusions and recommendations summarised below.

As might be expected, the preliminary findings on ICT management presented by the universities were very varied in terms of the levels or stages of development of ICT and ICT management. In all universities, however, the ICT field is dominated by the directors and staff of the computer centres.

The collective debate enabled the creation of a greater awareness of the complexity of ICT and the need to establish ICT management processes based on scientific models and techniques and appropriately incorporated in the general university management.

The findings presented by the participants were less profound than would be the findings of a systematic scientific survey of the problems relating to ICT management in their universities. The subject is far more complex than they indicated in their presentations. Thus there was shown to be a need for a more in-depth assessment of the ICT management situation in each of the universities (Exploration 2) using scientific methods and techniques, such as those described in Chapter 4, to explain the very complex causal links in real-life daily activities. As a consequence, the proposition set out in Chapter 1 was shown to be valid and it was considered that this proposition brings new knowledge to the universities.

With regard to building awareness (a) and to support (b) African universities in relation to the Big ICT Five, the following two statements were made:

- To understand the Big ICT Five and the relations between them, a conceptual model is required, describing the Big ICT Five and their inter-relations in detail.
- To support in a practical way the understanding and application of the Big ICT Five with respect to education, research and administration, an automated tool that is based on this model must be realized.
Chapter 4 - Presentation of applicable models for assessment of the six universities

4. PRESENTATION OF APPLICABLE MODELS FOR ASSESSMENT OF THE SIX UNIVERSITIES

4.1 Introduction

This chapter presents the following:

- A summary description of three models (see section 4.2) based on the models presented in Looijen [1998 and Supplement]. These models have been proven to apply in ICT management assessments in a number of research projects. The models are:
  - The MCM paradigm, which includes entities, relationships and external influences to reflect the main lines of an organization, the ICT used in that organization and that part of the organization which supports the ICT.
  - The State model/ Extended State Model, which includes a number of states to reflect the life cycle of ICT.
  - The Triple Model of MCM, which includes three kinds of MCM to reflect the organization of MCM.

- A series of subjects and objects, derived from the models, which have to be assessed in order to obtain information about the current status of ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization, and ICT service management (see Section 4.3).

4.2 Summary description of the models

4.2.1 The MCM paradigm

The MCM paradigm includes entities, relationships and external influences to reflect the main lines of an organization, the ICT used in that organization and that part of the organization which supports the ICT. The MCM paradigm encompasses three entities, six internal relationships and a number of external factors [Looijen1998] (See Figure 4.2.1).

![Figure 4.2.1 - MCM Paradigm](image-url)
Chapter 4 - Presentation of applicable models for assessment of the six universities

(a) The Real System (RS) entity

The RS entity reflects the organization and the processes within it which use ICT, taking into account the situational factors of the real system. The description includes the characteristics of the organization such as its nature, size, location, and age. It also draws attention to information about on-going processes, financial, material and human resources, and the demands on ICT.

The descriptions made in the RS entity will enable us to identify and qualify the strategic issues, development issues, acquisition processes, implementation issues, utilization aspects and service management issues that are current in the selected universities.

(b) The Information and Communication Technology (ICT) entity

The ICT entity reflects the hardware, software and communication facilities used in the RS and supported by the third entity (MCM). This description requires a very detailed formulation of the characteristics of all the ICT in use by RS and MCM. The description must include information and procedures about the hardware, software and data sets, and the relevant data processing procedures being made for practical applications and networking facilities within the organization.

The description made in the ICT entity will help us to identify and qualify the ICT available in the universities.

(c) The Management, Control and Maintenance (MCM) entity

The MCM entity reflects the organizations or parts of organizations that are involved in supporting the other entities (RS and ICT) and the ICT-related management processes which are used in providing this support. In the description, the tasks of each support unit are defined (task areas and task fields), together with the specifications for service level management for particular information systems, based on the requirements and preconditions formulated by the user organization.

The descriptions made in the MCM entity will help us to identify and to qualify organization(s) undertaking MCM activities for the selected universities.

4.2.1.1 Relationships between the entities

In the MCM paradigm the three entities establish interactions (relationships) in the form of the six relations or communication lines between them. The six relations are:

Relationship RS/ICT

RS $\rightarrow^1$ ICT

In relation 1 RS provides data to ICT in order to obtain the support it needs

RS $\leftarrow^2$ ICT

Relation 2 defines the way in which ICT supports RS by providing the tools required to realise its core functions.
Chapter 4 - Presentation of applicable models for assessment of the six universities

Relationship ICT/ MCM

ICT $\rightarrow_3$ MCM

In relation 3, ICT supports the MCM by delivering useful data (information) for Management, Control and Maintenance.

MCM $\rightarrow_4$ ICT

Relation 4 defines the way in which MCM manages ICT by establishing appropriate Management, Control and Maintenance units and processes.

Relationship RS/ MCM

RS $\rightarrow_5$ MCM

In relation 5, RS employs MCM to ensure that ICT meets specified performance requirements and preconditions.

MCM $\rightarrow_6$ RS

Relation 6 defines the way in which MCM responds to requests from RS by providing required levels of performance.

Assessment of these six relations in each university will provide information on how they are conducted.

4.2.1.2 External Influences

The three entities (RS, ICT, MCM) and their relationships (1/2, 3/4 and 5/6) are exposed to external influences – outside forces that may influence the situation of each entity and its relations.

For the purpose of our research, five external influences have been selected: the Economy, Education, Governance, Donors, and ICT Suppliers. In describing the selected influences it is necessary to go beyond the boundaries of the universities and to cover issues arising from the wider context, at the national, continental or international level.

The Economy

African countries are heavily indebted. This situation of weak economies and limited financial resources is reflected in the implementation of ICT development programmes. In Africa, for example, macro-economic support and the financial resources for governments to implement their programmes derive mainly from donations or loans. Donors and lenders in general strongly influence the development policies of African countries. Non-governmental organisations (NGOs) also provide donations for ICT activities, but they tend to operate with smaller amounts and at grassroots level.

We will examine whether and how the economy influences ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT service management.

Education

Given the shortage of qualified human resources (in general and in particular in the field of ICT), at all levels throughout Africa, the external influence is manifested by the importation of qualified, educated human resources from outside the organisation or country, under the heading of Technical Assistance (TA). We cannot call TA an “improper method” but, given that it is limited in duration and concentrated in education programmes (in particular technologically oriented education), it has not been as successful as expected.
This is partly a result of technical assistants' lack of understanding of the context and culture in which they are required to work. In many African countries, TA has had a continuous influence. This outside influence can also be seen in the case of graduates educated outside their home country, in many cases outside the continent, who bring back different experiences from a different context and culture. In Mozambique, for example, the cultural variability of technical assistance is evident: UEM receives technical assistance from, among others, the Netherlands under the MHO programme, while the Ministry of Finance receives technical assistance from Harvard University.

We will examine whether and how the level of education affects ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT service management.

**Governance**

This is related to the existence or creation of policy tools, coordination tools and managerial tools at the national level, including ICT policies, ICT legislation and new regulations from Ministries, for example relating to ICT imports, research on ICT and the development of the ICT industry. Governance models can influence ICT, in particular if there is a multiple relationship between the university and higher-level external bodies with the power and mandate for making decisions about the university.

This external influence is felt when policy tools do not exist, or cannot be enforced. In this case external influences will govern the implementation of ICT in an ad hoc way. This situation is exemplified by the situation in Mozambique (see Figure 4.2.2). Relation 1 indicates the relation between the university and the Head of State (President); relation 2 is the relation between the university and the Prime Minister (PM); relation 3 is that with the Ministry of Plan and Finance (MPF); relation 4 is with the Ministry of State Administration (MAE); and relation 5 is with the Ministry of Higher Education, Science and Technology (MESCT). Through these relationships, inconsistent or even conflicting pressures can be imposed on the university. When enforceable external rules do exist, they tend to serve as general frameworks, and may not take into account the specific details of the organisation.

![Figure 4.2.2 - External Influence – Governance](image)

In the assessment we will examine whether and how university governance influences the university policy and ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT service management.
Chapter 4 - Presentation of applicable models for assessment of the six universities

Donors
Many donors have ICT-related projects in Africa. These projects are financed from outside the beneficiary countries or organisations. Such projects are often not part of the strategy of the organisation or the nation and it is not clear how the activities born from such projects can be continued and sustained when the projects terminate. In what can be regarded as cultural colonisation, donors provide financing through tied aid and impose unrealistic conditions for the implementation of projects.

We will examine whether and how donors influence universities in relation to ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT service management.

ICT Suppliers
Every day new and more sophisticated ICT is produced and made available on the market with an apparent reduction in cost but with increased technological complexity. At the same time, researchers, on behalf of technology suppliers, develop advanced techniques for the marketing and sale of ICT.

Three continents produce ICT: America, Asia, and Europe. Companies from these continents, with the North American ones in the lead, flood the world with new ICT through networks of suppliers. This results in an international ICT business supply chain. In such a chain, individual institutions – particularly those in poor developing countries – have little control of events and processes related to ICT Requests for Proposals (RFPs) and ICT delivery to the client organisation.

In many cases capability, experience and know-how are limited [Looijen1998 Supplement], leaving the organisation exposed to market forces. Frequently, the fast pace of developments means that the organisations have insufficient time to master ICT which has been acquired before it is replaced by a newer version.

We will examine whether and how technology and suppliers influence ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT service management.

4.2.1.3 The expansion of the basic MCM paradigm

For a better understanding of the future use of the MCM paradigm in the context of our research, this section presents the expansion of the MCM paradigm and outlines the main elements of each entity (RS, ICT, MCM) that will be assessed in each of the selected universities.

(a) The RS and its expansion

To obtain a clear picture of the Real System (RS), specific activities related to the main core business of the RS (the university setting) will be identified. The number of specific activities will depend on the findings in the field based on the elaboration of the basic MCM paradigm. For illustration, the following eight university activities are given in Figure 4.2.3.

These eight activities constitute the main elements of the RS and will be looked at in detail during the explorations.
Chapter 4 - Presentation of applicable models for assessment of the six universities

1. education;
2. distance education;
3. research;
4. personnel administration
5. student administration
6. finance administration;
7. asset management;
8. library operations.

Figure 4.2.3 - The expansion of the RS entity

(b) The ICT and its expansion

A complete picture of available ICT components within a university requires the development of an inventory of the components and their characteristics. The ICT supports the specific processes in the (RS).

As an illustration, the following twelve types of ICT are shown in Figure 4.2.4. Each element of ICT can have one or more relations with a specific activity of the RS.

Figure 4.2.4 - The expansion of the ICT entity

(c) The MCM (and its expansion)

MCM tasks are undertaken by different organisations, in order to maintain the ICT components functionally required by the RS.

Identification of each organisation undertaking MCM tasks and delineation of its ICT functions and responsibilities is a fundamental requirement. One or more organisations may be identified. In Figure 4.2.5 we give an illustration of how MCM repeats (is expanded).
4.2.2 The State Model/ Extended State Model

4.2.2.1 The State Model

The State Model/ Extended State Model includes a number of States to reflect the life cycle of ICT.

The collection of the various states in the life cycle of an ICT is designated as the State Model. In its basic version (Figure 4.2.6) the State Model includes the following six states:

- Information Policy and Information Planning state (IPP)
- Development state (D)
- Acceptance and Implementation state (AI)
- Utilization state (U)
- Exploitation state (E)
- Maintenance state (M)

A description of what occurs in each state follows:

The Information Policy and Information Planning State (IPP) In this state the common vision of ICT requirements for the organization is defined. The common vision is presented in a document aligned with the organization's general strategic plan and provides policy guidance. It constitutes the framework for the development/acquisition, implementation, utilization, management, maintenance and control of the ICT for the entire organization. This state is followed by the state development/acquisition of the required ICT.
The Development State (D) In this state ICT is materialised by developing/acquiring or designing and constructing ICT resources and infrastructures. The ICT may or may not be accepted in the next state.

The Acceptance and Implementation State (AI) In this state the ICT is tested and accepted or not accepted. If accepted, it can proceed to the next state for use or exploitation. If not accepted, the ICT will be sent back to the previous state for redesign or reconstruction until it becomes acceptable.

The Utilization State (U) In this state users in their daily activities use the ICT in all its functions.

The Exploitation State (E) In this state, the organization is expected to take full advantage of ICT in the realization of its aims and objects.

The Maintenance State (M) In this state, all or part of the ICT can benefit from change or modification as a result of maintenance, initiated from the states U and E.

The life cycle of ICT starts with the definition of an information policy and ends when the information system is phased out of the organisation. During its life cycle and as a consequence of controlled utilization, the ICT is subject to changes and modification.

The Extended State Model derives from the State Model.

4.2.2.2 The Extended State Model

The Extended State Model can illustrate the advancement of an ICT, together with its consequences for an organisation. The changes and modifications in the state M can be classified into two categories. The first category (M1) consists of changes/modifications, which, after implementation, result in minimal change in the states U1 and E1. The second category (M2) consists of major changes/modifications which, after implementation, result in a change/modification of at least one of the states U2 and E2. This amended State Model is thus known as the Extended State Model (Figure 4.2.7). The states AI, U1, E1 and M1/M2 can be repeated as many times as needed depending on the circumstances.

![Figure 4.2.7 - Extended State Model](image)

By applying the State Model and the Extended State Model during the assessment, we will be able to better situate the ICT existing within each university in accordance with the different states of the life cycle.

4.2.3 The Triple Model of MCM

The Triple Model of MCM includes three kinds of MCM to reflect the organization of MCM, as illustrated in Figure 4.2.8:
Functional Management (FM) This kind of management is related to the maintenance and control of the functionality of the information system. It supports the utilization of the functions, evaluates utilization and reacts to deficiencies and new requirements, which may lead to modifications. Functional management is undertaken by the user unit to ensure that user specifications and definitions of responsibility are implemented at an adequate level. Table 4.2.1 shows FM tasks and will be used to present an overview of which FM tasks are undertaken in each university, how they are undertaken and by whom.

<table>
<thead>
<tr>
<th>Task Areas/Task Fields</th>
<th>Organization(s) involved in FM tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic Management (SM)</td>
<td></td>
</tr>
<tr>
<td>Tactical Management (TM)</td>
<td></td>
</tr>
<tr>
<td>Technical Support (Tsu)</td>
<td></td>
</tr>
<tr>
<td>• Hardware and basic software support</td>
<td></td>
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<tr>
<td>• Communication support</td>
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<tr>
<td>• DBMS support</td>
<td></td>
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<tr>
<td>• Management of (PC) application packages</td>
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<tr>
<td>• Research</td>
<td></td>
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<tr>
<td>• Management of technical and communication facilities</td>
<td></td>
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<tr>
<td>Personnel Management (PM)</td>
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<tr>
<td>• Personnel Management</td>
<td></td>
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<tr>
<td>General Business Support (GBS)</td>
<td></td>
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<tr>
<td>• Administrative Management</td>
<td></td>
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<tr>
<td>• Quality Control</td>
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<tr>
<td>• Capacity Planning</td>
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<tr>
<td>• Order Control</td>
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<tr>
<td>• Budgeting</td>
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<tr>
<td>• Charging Back</td>
<td></td>
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<tr>
<td>• Acquisition of ICT Resources</td>
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<tr>
<td>Operational Management (OM)</td>
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<tr>
<td>Utilization Management (UM)</td>
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<tr>
<td>• User Support</td>
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<tr>
<td>• Functional System Management</td>
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<tr>
<td>• Management Business Data</td>
<td></td>
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<tr>
<td>Functional Maintenance (FM)</td>
<td></td>
</tr>
<tr>
<td>• Maintenance of Manual Procedures</td>
<td></td>
</tr>
<tr>
<td>• Functional Maintenance of Information Systems</td>
<td></td>
</tr>
<tr>
<td>• Data Definition Control</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.2.1 – FM task areas/task fields
Chapter 4 - Presentation of applicable models for assessment of the six universities

Application Management (AM): This kind of management is related to activities that aim to ensure, via a control system, that maintenance of existing ICT (such as software applications and databases) takes place within the established parameters.

The term “application software” refers to all software other than operating systems (such as UNIX), database management software and programming tools. It refers to the software that has been installed “on top of” basic software and database management software or has been developed or customised as application software. Personnel and Payroll Information System (PPIS) and Academic Registry Information System (ARIS) are examples of application software. Application software together with application packages falls under application management.

When changes have to be made, application management is responsible for carrying out and testing modifications. This also applies to databases, data modelling and database structures. AM can be undertaken by a technical unit, such as the computer centre, or by a software house. The technical unit may or may not belong to the same organisation as the user unit.

Table 4.2.2 shows the AM tasks and will be used to present an overview of which AM tasks are undertaken in each university, how they are undertaken and by whom.

<table>
<thead>
<tr>
<th>Task Areas/ Task Fields</th>
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<tr>
<td>Strategic Management (SM)</td>
<td></td>
</tr>
<tr>
<td>Tactical Management (TM)</td>
<td></td>
</tr>
<tr>
<td>Technical Support (TSu)</td>
<td></td>
</tr>
<tr>
<td>• Hardware and basic software support</td>
<td></td>
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<tr>
<td>• Communication support</td>
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<tr>
<td>• DBMS support</td>
<td></td>
</tr>
<tr>
<td>• Management of (PC) application packages</td>
<td></td>
</tr>
<tr>
<td>• Research</td>
<td></td>
</tr>
<tr>
<td>• Management of technical and communication facilities</td>
<td></td>
</tr>
<tr>
<td>Personnel Management (PM)</td>
<td></td>
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<tr>
<td>• Personnel Management</td>
<td></td>
</tr>
<tr>
<td>General Business Support (GBS)</td>
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</tr>
<tr>
<td>• Administrative Management</td>
<td></td>
</tr>
<tr>
<td>• Quality Control</td>
<td></td>
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<tr>
<td>• Capacity Planning</td>
<td></td>
</tr>
<tr>
<td>• Order Control</td>
<td></td>
</tr>
<tr>
<td>• Budgeting</td>
<td></td>
</tr>
<tr>
<td>• Charging Back</td>
<td></td>
</tr>
<tr>
<td>• Acquisition of ICT Resources</td>
<td></td>
</tr>
<tr>
<td>Operational Management (OM)</td>
<td></td>
</tr>
<tr>
<td>Application Maintenance (AM)</td>
<td></td>
</tr>
<tr>
<td>• Maintenance of Application Software</td>
<td></td>
</tr>
<tr>
<td>• Database Management</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.2.2 – AM task areas/task fields

Technical Management (TM): This kind of management is responsible for the maintenance and control of the operational status of the ICT - the hardware, software and data sets - which must be continuously available. Technical management is responsible for servicing all ICT infrastructures and maintaining its continuous operation. TM controls agreed performance levels, anticipates deviations and carries out modifications resulting from user requirements and technological developments. Any modifications made should be geared to satisfying user requirements.
Table 4.2.3 shows the TM tasks and will be used to present an overview of which TM tasks are undertaken in each university, how they are undertaken and by whom.

<table>
<thead>
<tr>
<th>Task Areas/ Task Fields</th>
<th>Organization(s) involved in TM tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic Management (SM)</td>
<td></td>
</tr>
<tr>
<td>Tactical Management (TM)</td>
<td></td>
</tr>
<tr>
<td>Technical Support (TSu)</td>
<td></td>
</tr>
<tr>
<td>• Hardware and basic software support</td>
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<tr>
<td>• Communication support</td>
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<tr>
<td>• DBMS support</td>
<td></td>
</tr>
<tr>
<td>• Management of (PC) application packages</td>
<td></td>
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<tr>
<td>• Research</td>
<td></td>
</tr>
<tr>
<td>• Management of technical and communication facilities</td>
<td></td>
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<tr>
<td>Personnel Management (PM)</td>
<td></td>
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<tr>
<td>• Personnel Management</td>
<td></td>
</tr>
<tr>
<td>General Business Support (GBS)</td>
<td></td>
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<tr>
<td>• Administrative Management</td>
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<tr>
<td>• Quality Control</td>
<td></td>
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<tr>
<td>• Capacity Planning</td>
<td></td>
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<tr>
<td>• Order Control</td>
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<td>• Budgeting</td>
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<tr>
<td>• Charging Back</td>
<td></td>
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<tr>
<td>• Acquisition of ICT Resources</td>
<td></td>
</tr>
<tr>
<td>Operational Management (OM)</td>
<td></td>
</tr>
<tr>
<td>Maintenance Technical Infrastructure and Operational Support (MTI-OS)</td>
<td></td>
</tr>
<tr>
<td>• Changing Technical Infrastructure</td>
<td></td>
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<tr>
<td>• Problem Management</td>
<td></td>
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<tr>
<td>• Availability Control</td>
<td></td>
</tr>
<tr>
<td>• Disaster Recovery</td>
<td></td>
</tr>
<tr>
<td>• Security</td>
<td></td>
</tr>
<tr>
<td>Operational Control (OC)</td>
<td></td>
</tr>
<tr>
<td>• Acceptance</td>
<td></td>
</tr>
<tr>
<td>• Operating</td>
<td></td>
</tr>
<tr>
<td>• Hardware Configuration Management</td>
<td></td>
</tr>
<tr>
<td>• Software Configuration Management</td>
<td></td>
</tr>
<tr>
<td>• Physical Data Management</td>
<td></td>
</tr>
<tr>
<td>• Utilization Analysis</td>
<td></td>
</tr>
<tr>
<td>• Performance Management</td>
<td></td>
</tr>
<tr>
<td>• Tuning</td>
<td></td>
</tr>
<tr>
<td>Technical Services (TSe)</td>
<td></td>
</tr>
<tr>
<td>• Management of the Range and Cost of Services</td>
<td></td>
</tr>
<tr>
<td>• Data Processing</td>
<td></td>
</tr>
<tr>
<td>• Advice and Participation</td>
<td></td>
</tr>
<tr>
<td>• Information Supply</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.2.3 – TM task areas/task fields

4.2.3.1  The Three Kinds of MCM applied to the Mintzberg Logo

The Mintzberg Logo (see Figure 4.2.9) depicts each organization in its main form: for a university the strategic apex represents university governance and top management; the middle line represents academic management staff and administrative management staff; the techno-structure (left side) represents the technical, administrative and support staff; the
support staff (right side) represents the ICT support staff, and the operating core (base) represents the academic and administrative staff involved in education and student affairs [Mintzberg1994].

Figure 4.2.9 - The Mintzberg Logo applied to a university

Looijen applied the Mintzberg Logo to the case of a university [Looijen1998] to place and represent the three management levels of MCM within each management unit, together with the relationship between the three kinds of management (Functional, Application and Technical Management). Figure 4.2.10 summarizes also the task areas/task fields presented in Tables 4.2.1, 4.2.2, and 4.2.3, and reflects the classification of the management tasks into task areas/task fields and their positioning at strategic, tactical and operational levels.

**Strategic level** determines the policy, which consists of directives defined by the organisation (the university's governance process and the university's top management) regarding the content of Functional, Application and Technical Management, the place or places where these are located within and outside the university and the relationships which have to be maintained with other management units in the university or outside it.

**Tactical level** (the academic and administrative management) involves the translation of the policy into responsibilities assigned to technical and the human resources for operations and for university business support. At this level we find the task areas of technical support, personnel management and general university business support, each one directed towards an operational Functional, Application and Technical Management.

**Operational level** (the academic and administrative staff involved in education and students) is responsible for the task areas utilization management, functional maintenance (which provides direct support for users), application maintenance (which provides direct support for modification of application software data bases), operational control, maintenance of technical infrastructure, operational support and technical services (which support directly the exploitation of information management).

MCM functions occur in different parts of an organization, and may involve more than one organization (see Figure 4.2.10). In each MCM unit, the number and complexity of tasks depends on the situation in each organisation, the manner in which ICT is managed and dispersed, and also on the level of knowledge of ICT in the organisation.
Chapter 4 - Presentation of applicable models for assessment of the six universities

By using the Three Kinds of MCM model in the assessments, we will be able to determine how these three forms of management are carried out and, if so, how (at what level). It will also allow us to determine how the tasks associated with FM, AM, and TM are being realized. This will be important for the identification of missing issues related to ICT Service Management.

Together the three models represent an overall reference model which includes the relevant subjects and objects for an effective and efficient application of ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT Service Management, together defined as ICT management.

4.3 Subjects and objects for assessment

In order to obtain a thorough understanding of the current state of the Big ICT Five in the selected universities, we have to focus on a number of subjects and objects which are explicitly or implicitly part of the models described above, and on how these subjects and objects function in, or affect, the university environment.

The following paragraphs present the subjects and objects to be studied by reference to each model in the assessment of the six universities in Chapters 5 to 10.

4.3.1 Subjects and objects for assessment of the entity Real System using the MCM paradigm

In relation to the entity Real System the following subjects and objects are assessed:

- Historical background: to contribute to the understanding of the present situation and the possible direction of future developments.
- Location
- Organization
  - Organizational Structure
  - Education and Research
- Services
  - Transport
  - Library
  - Security
Chapter 4 - Presentation of applicable models for assessment of the six universities

- Social Services for Students
- Housing
- ICT

- Administration supporting education, research, and services

- People
  - Numbers
  - Education
  - Experience
  - Personnel Turnover

- Situational Factors
  - Specific situational factors such as:
    - Culture of the organisation
    - Starting point of ICT
  - General situational factors such as:
    - Relationships with ICT suppliers
    - Discontinuity of management

With regard to the Big ICT Five, particular attention is given in the assessment to deriving the status of ICT strategy.

4.3.2 Subjects and objects for assessment of the entity ICT using the MCM paradigm

In relation to the entity ICT, the following subjects and objects are assessed:

- Complexity factors
  - Quantity refers to the number of ICT components, e.g. hardware, software, and communication facilities.
  - Diversity refers to the variation in type and origin.
  - Distribution refers to the geographical dispersal of the ICT
  - Dynamics refers to the rate and manner of changes and modifications in the ICT
  - Functionality refers to the variety of functions
  - Relationships refers to the degree of linkages
  - Ownership
  - Utilization refers to the different types of users, their requirements and preconditions.
  - Sophistication refers to the degree of advancement and difficulty to understand the ins and outs.

- Hardware/Software/Communication characteristics, such as
  - Network capacity
  - Standardization
  - Quality of technical facilities

- Dataset characteristics, such as
  - Extent of existing databases
  - Standardization
  - Database management software

- Procedures characteristics, such as
  - Number
  - Extent
Chapter 4 - Presentation of applicable models for assessment of the six universities

- User friendliness
- Language

With regard to the ICT Big Five, particular attention is given in the assessment to: the level of complexity of the ICT (e.g. a high degree of complexity needs more professional ICT service management than a lesser degree of complexity; greater complexity requires greater effort for implementation of a new ICT than lesser complexity, etc.)

4.3.3 Subjects and objects for assessment of the entity MCM using the MCM paradigm

In relation to the entity MCM, the following subjects and objects are assessed:

- Organization, taking account of the Three Kinds of MCM Model and Expansion of the Three Kinds of MCM Model
- Tasks, taking into account task areas and task fields
- Processes, including:
  - Incident management
  - Problem management
  - Change management
  - Configuration management
  - Release management
  - SLA management
  - Capacity management
  - Contingency management
  - Availability management
  - Cost management
  - Network services management
- Procedures, in written and oral form
- People
  - Number
  - Education
  - Experience
  - Personnel turnover

With regard to the ICT Big Five, particular attention is given in the assessment to deriving the status of ICT service management.

4.3.4 Subjects and objects for assessment of internal relationships using the MCM paradigm

In relation to the internal relationships, the following subjects and objects are assessed:

Relation RS → ICT: RS provides data to ICT in order to obtain the support it needs
Relation RS ← ICT: The way in which support is provided
Relation ICT → MCM: Kinds of data to support MCM
Relation ICT ← MCM: The way in which management is provided
Relation RS → MCM: Requirements and preconditions

Relation RS ← MCM: The way in which support is provided

With regard to the ICT Big Five, particular attention is given to assessing the strong and weak points of the following relations and objects:
- in Relations RS/ICT and ICT/RS: ICT utilization
- in Relations ICT/MCM and MCM/ICT: ICT Service Management (Technical, Application Management)
- in Relations RS/MCM and MCM/RS: ICT Service Management (SLAs), ICT strategy.

4.3.5 Subjects and objects for assessment of the external influences using the MCM paradigm

In relation to the external influences, the following subjects and objects are assessed:
- Economy
- Education
- Governance
- Donors
- ICT Suppliers

Particular attention is given in the assessment to the impact of the external influences on the Big ICT Five.

4.3.6 Subjects and objects for assessment using the State Model/ Extended State Model

In relation to these models the following subjects and objects are assessed:
- University Network: state(s), tasks and processes
- Local Area Networks: state(s), tasks and processes
- General Information Systems, such as:
  - Payroll and Personnel Information System: state(s), tasks and processes
  - Student Information System: idem
  - Library Information System: idem
  - Financial Information System: idem
  - Assets Information System: idem
  - ICT-based Distance Education: idem
  - University MIS: idem

With regard to the ICT Big Five, particular attention is given in the assessment to the way in which ICT implementation takes place, distinguishing between the different states of the State Model and the Extended State Model.

4.3.7 Subjects and objects for assessment using the Three Kinds of MCM Model and the Expansion of the Three Kinds of MCM Model

In relation to this model, the following subjects and objects are assessed:
- Functional Management (FM)
  - Organization
  - Tasks
  - Processes
  - Procedures
  - People
Chapter 4 - Presentation of applicable models for assessment of the six universities

- Application Management (AM)
  - Organization
  - Tasks
  - Processes
  - Procedures
  - People

- Technical Management (TM)
  - Organization
  - Tasks
  - Processes
  - Procedures
  - People

With regard to the ICT Big Five, particular attention is given in the assessment to the way in which the Three Kinds of MCM are distinguished and implemented, at different management levels, by the organizations involved in ICT management, at strategic level (university top management), at tactical level (university computer centre, faculties and administrative units) and at operational level (university computer centre, faculties and administrative units, external ICT services, suppliers, ICT consultants).

We shall now enter the six universities to assess them in accordance with the subjects and objects we have prescribed.
University of Botswana (UoB)

Information about UoB was obtained from UoB annual reports, strategic plan, other publications, www.ub.bw and field assessment, and was verified by the Director of the Computer Centre.

Botswana
5. **ASSESSING THE UNIVERSITY OF BOTSWANA (UOB)**

**Introduction**
The objective is to assess the Big ICT Five in the University of Botswana (UoB) by applying the models presented in Chapter 4. For the assessment we will follow the outline presented in Section 4.3 of Chapter 4.

**5.1 Subjects and objects for assessment of the entity Real System using the MCM paradigm**

For the entity Real System, we focus on the following subjects and objects:
- Historical Background
- Location
- Organization
- Services
- Administration supporting education, research, and services
- People
- Situational Factors

**Historical background**
The opening of the University of Basutoland, Bechuanaland and Swaziland (UBBS) on January 1st 1964 was the outcome of an agreement reached in mid 1962 between the High Commission Territories and the Oblate of Mary Immaculate of Pius XII Catholic University, Roma, Lesotho. Pius XII College of Roma, 35 kilometres from Maseru, was itself the product of the desire for an institution of higher learning for Africans by the Catholic hierarchy in Southern Africa. It opened its doors to students in 1946, with five students and five priest lecturers. In 1950, it was taken over by the Catholic Order of the Oblate of Mary Immaculate.

UBBS became UBLs (the University of Botswana, Lesotho and Swaziland) in 1966 on the Independence of Botswana and Lesotho. With independence, the three countries began to take a closer look at the colonial inheritance of education, including their joint university, and began to identify the role of UBLs in higher- and middle-level training. A series of academic planning reports for UBLs produced after 1966 culminated in the second Alexander Report of 1970, which combined the major recommendations of previous reports for the development of university campuses in each country and the unified development of higher education and vocational and teacher training.

His Excellency Sir Ketumile Masire, then President of the Republic of Botswana, performed the formal inauguration of the University of Botswana on 23rd October 1982. Under the terms of an agreement between the Governments of Botswana and Swaziland, the National Universities in Botswana and Swaziland would continue to exchange students and to cooperate in certain areas and to that end an Advisory Committee was set up to advise on how best to co-operate. The current Chancellor of the University of Botswana is His Excellency Mr Festus Mogae, President of the Republic of Botswana.

**Location**
The university of Botswana has three campuses. The main campus is located in Gaborone, the capital of Botswana. The Francistown campus is about 500 km from the main campus, and the Maun Campus is about 950 km from Gaborone.

**Organization**

**Organizational Structure.** The organizational structure of UoB can be fitted into the Mintzberg logo as illustrated in Figure 5.1.1.
**Chapter 5 – Assessing the University of Botswana (UoB) - Botswana**

![Diagram](image)

Figure 5.1.1 - The Mintzberg Logo applied to UoB [UoB2000]

**Education and Research.** Education and research activities are undertaken within eight academic units, which are different faculties/departments, research centres, and schools (Table. 5.1.1). In relation to education and research in the area of ICT, the Faculty of Science contains the Department of Computer Science, which offers computer science courses. The Engineering and Technology Faculty includes in its curricula computing-related disciplines. The computer centre provides training for users. Through the faculties, UoB offers four-year B.Sc. degrees as well as Master’s and Doctoral degrees in a number of programmes, including in the ICT-related field.

<table>
<thead>
<tr>
<th>Faculties (F1 – F6), Centres and Units</th>
<th>Courses</th>
<th>Staff</th>
<th>Student population (as per: 5/09/2001)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1. Faculty of Business</td>
<td>• Accounts &amp; Finance</td>
<td>39</td>
<td>796</td>
</tr>
<tr>
<td></td>
<td>• Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Marketing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F2. Faculty of Education</td>
<td>• Adult Education</td>
<td>134</td>
<td>2192</td>
</tr>
<tr>
<td></td>
<td>• Educational Foundations</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>• Educational Technology</td>
<td></td>
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<tr>
<td></td>
<td>• Home Economics Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Language &amp; Social Sciences</td>
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<td></td>
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<tr>
<td></td>
<td>• Maths &amp; Science Education</td>
<td></td>
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<td></td>
<td>• Nursing Education</td>
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<td></td>
<td>• Physical</td>
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<td></td>
<td>• Primary Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F3. Faculty of Engineering &amp; Technology</td>
<td>• Civil Engineering</td>
<td>66</td>
<td>1184</td>
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<td></td>
<td>• Electrical Engineering</td>
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</tr>
<tr>
<td></td>
<td>• Mechanical Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Technology &amp; Educational Studies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F4. Faculty of Humanities</td>
<td>• African Languages &amp; Literature</td>
<td>99</td>
<td>2074</td>
</tr>
<tr>
<td></td>
<td>• English</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• French</td>
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<td></td>
<td>• History</td>
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<tr>
<td></td>
<td>• Library &amp; Info Studies</td>
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<td></td>
<td>• Theology &amp; Religious Studies</td>
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<td></td>
<td>• Media Studies</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• Medical Education</td>
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</tr>
</tbody>
</table>

Table 5.1.1 – Academic and non-academic staff and student population for each unit, and courses offered by UoB, 2001
<table>
<thead>
<tr>
<th>Faculties (F1 – F6), Centres and Others Units</th>
<th>Courses</th>
<th>Staff</th>
<th>Student population Date: 5/09/2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>F5. Faculty of Science</td>
<td>Biological Sciences, Chemistry, Computer Science, Environmental Science, Geology, Mathematics, Physics</td>
<td>166 -</td>
<td>1344</td>
</tr>
<tr>
<td>Centre for Continuing Education (CCE)</td>
<td>Distance Education Unit, Extra Mural Unit, Public Education Unit</td>
<td>- -</td>
<td>980</td>
</tr>
<tr>
<td>Centre for Academic Development (CAD)</td>
<td>Affiliated Institutions, Communication and Study Skills, Educational Technology, Programme Review, Teaching and Learning</td>
<td>44 -</td>
<td></td>
</tr>
<tr>
<td>Office of Research and Development (R&amp;D)</td>
<td>Policies, Research &amp; Funding Opportunities</td>
<td>4 -</td>
<td></td>
</tr>
<tr>
<td>Harry Oppenheimer Okavango Research Centre (H.O.O.R.C), UoB Foundation, Computer Centre, UoB Library</td>
<td></td>
<td>- -</td>
<td></td>
</tr>
<tr>
<td>Administrative Units (Finance, Maintenance, Security and other units)</td>
<td></td>
<td>- -</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>658 1547 10826</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.1.1 (cont) - Academic and non-academic staff and student population for each unit, and courses offered by UoB, 2001

**Services**

The university provides a number of services to support its main mission of education and research. Such services include:

- **Transport**: The university provides transport services for staff and students.
- **Library**: The university provides on-line services in its central library to students and academic staff. The available university (central) library provides support to students and academic staff in the form of books, journals and ICT facilities for accessing relevant information.
- **Security**: The university has security services to safeguard and protect its assets.
- **Social Services**: The university provides to the students and staff social services such as health care services, career and counselling services, legal services.
Chapter 5 – Assessing the University of Botswana (UoB) - Botswana

**Housing:** The university provides student accommodation facilities.

**ICT:** The university has a Computer Centre, also known as the IT department, which provides ICT services to the university.

**Administration supporting education, research, and services**

The organizational chart of UoB's administration and managerial structure (Officers of the university (Vice Chancellor and three Deputy Vice Chancellors), University Council, and the Senate) is presented in Figure 5.1.2.

![Organization Chart of UoB Administrative Structure, 2000](image)

**Figure 5.1.2 - Organization Chart of UoB Administrative Structure, 2000**

The Chancellor is the President of Botswana. The Vice Chancellor is the most senior day-to-day authority within the university and is responsible for the administration of the whole university. In her duties she is assisted by the Deputy Vice Chancellor for Academic Affairs, Deputy Vice Chancellor for Finance and Administration Affairs, and Deputy Vice Chancellor for Student Affairs.

The University Council is the governing body of the university and has the ultimate responsibility for the activities and progress of the university towards achievement of its goals. Under the University Council, the Senate has the responsibility for the general control and direction of teaching and research activities and the awarding of degrees, diplomas and certificates.

The Deputy Vice Chancellor for Academic Affairs works closely with the Senate. He coordinates the day-to-day activities of all units where education and research activities are conducted: faculties and departments, the central library, research and development and continuing education.
The Deputy Vice Chancellor for Financial and Administration affairs coordinates the everyday activities of the Directorate of Finance. The Directorate of Finance centralizes the management of the university finance system, provides support to the university units in the realization of financial procedures and processes, and also deals with the central acquisition of goods for the university in coordination with acquisition committees established when needed. It is also responsible for the management of the inventory of the university’s assets and depreciations.

The Directorate of Human Resources centralizes the administration of university staff and provides support in human resource administrative issues. This directorate shares with the Finance Directorate the administration of the university payroll.

The Computer Centre provides support to the academic and administrative units in relation to the acquisition and implementation of ICT and the delivery of technical services for it. For ICT acquisition, a committee made up of members from different academic and administrative units works in close cooperation with the computer centre.

The Directorate of Campus Services provides services for the whole university through the management of the university campus, in the form of maintenance of buildings and infrastructures, and physical planning of the campus.

Under the Deputy Vice Chancellor for Student Affairs, services aiming to deal with social affairs and support to students are provided by the following directorates: Academic Services, in which student records and academic progress are centrally monitored; Student Welfare, where student accommodation and catering facilities are managed; Careers and Counselling Services; Culture, Sports and Recreation Services; and Health Services.

The daily administrative activities implemented under the university structure indicated in Figure 5.1.2 are being stimulated by the introduction of reforms aiming to improve the university management and administration. As part of the ongoing processes, the following administrative reforms are underway: design and implementation of the university strategic plan, upgrading of the university infrastructure, and the design and implementation of the Information Technology Policy & Strategy.

In response to the government’s decision that universities must design a strategic plan, the University of Botswana has embarked on the process of designing its strategic plan. It is being developed under the Vision, Mission and Values Statement indicated in Figure 5.1.3. A draft version is available.

In relation to the Information Technology Strategy, the university has drafted a version (version 1.11 of May 2001) which not only identifies the strategic issues related to the ICT for the university but also contains policies and procedures for strategic actions. In its ICT strategy the university clearly addresses the issue of ICT with a view that the ICT must provide support to its main mission by addressing issues related to: funding and accountability, teaching and learning, classroom transformation, e-learning strategy, access to facilities, ICT management and administration, research, the university library, Internet, Email and World Wide Web, the university network, the hardware and software, technical support, replacement, user support, provision for special needs, system and equipment disposal, IT training, business continuity plan and infrastructure availability, security, monitoring, reviewing and maintenance of the strategy. In the document, the university sets out its ICT policy, which applies to all ICT and electronic records owned by the university or licensed to it and to all individuals who are granted access to ICT resources and facilities owned and operated by the university, including, but not necessarily limited to, staff, students, researchers and visiting scholars. The policy covers issues such as university data ownership, the appropriate use of ICT resources, ICT resources management, information security, electronic mail policy, enforcement and penalties for violations.
### University of Botswana
#### Vision, Mission and Values Statement

1. **Vision**
   
   The University of Botswana will be a leading academic centre of excellence in Africa and the world.

2. **Mission**
   
   To advance the intellectual and human resource capacity of the nation and the international community.
   
   The University will fulfill this Vision and Mission by:

   2.1 Offering quality academic and professional programmes that ensure a commitment to and a mastery of life-long learning skills as well as encouraging a spirit of critical enquiry

   2.2 Developing a student-centred, intellectually stimulating and technologically advanced teaching, learning and research environment

   2.3 Producing graduates who are independent, confident, self directed, critical thinkers, professionally competent, reflective practitioners, innovative, socially responsible and thereby marketable and competitive nationally and internationally

   2.4 Advancing scholarship and generating research through the discovery, integration, dissemination and application of knowledge

   2.5 Serving as an intellectual and cultural centre that draws upon the nation’s indigenous knowledge base and which promotes Botswana’s social and cultural heritage as well as being a community resource for new ideas, partnerships, and collaborative effort

   2.6 Providing leadership in responding to the nation’s cultural, economic, political, scientific, social, technological and industrial needs and contributing to the qualitative development of Botswana’s higher education system

   2.7 Extending access to higher education through the utilization of information and communication technologies, within the framework of life-long and open learning

   2.8 Recruiting and developing quality staff and students, recognising and valuing the essential contribution they make, as well as rewarding excellence in the work they perform

   2.9 Promoting the health, social, and spiritual welfare of the University community through a range of policies and programmes and a diversity of positive co-curricular activities and experiences

   2.10 Enhancing the teaching, learning and research environment through the provision of a proactive style of leadership and management and efficient, effective and quality driven institutional support services

3. **Values**

   While achieving its Vision and fulfilling its Mission, the University of Botswana values the following:

   3.1 Students, by creating a holistic environment which ensures that learning is their central focus and by establishing and developing a range of learning, social, cultural and recreational opportunities that will facilitate the full realization of their potential for academic and personal growth

   3.2 Academic Freedom, by upholding the spirit of free and critical thought and enquiry, through the tolerance of a diversity of beliefs and understanding, as well as the open exchange of ideas and knowledge

   3.3 Academic Integrity expressed in creativity, objective analysis, experimentation, critical appraisal, independent thought, informed debate and intellectual honesty

   3.4 Cultural Authenticity by ensuring that the diversity of Botswana’s indigenous values and cultural heritage forms an important part of the academic and organizational life of the institution

   3.5 Internationalism through participation in the global world of scholarship, by being receptive and responsive to issues within the international environment as well as the recruitment of an international staff and student body

   3.6 Professional and Ethical Standards by upholding the highest professional and ethical behaviour and through openness, honesty, tolerance and respect for the individual

   3.7 Social responsibility by promoting an awareness of, and providing leadership in responding to, the issues and problems facing society

   3.8 Equity by ensuring equal opportunity and non-discrimination on the basis of personal, ethnic, religious, gender or other social characteristics

   3.9 Autonomy as an institution, that is, through its self-governing structures, independent in action while being responsive to societal needs

   3.10 Public Accountability by ensuring transparent decision-making and open review as well as the full participation of stakeholders in the development of the institution;

   3.11 Productivity through the setting and rewarding of high standards of performance underpinned by a dedication to quality, efficiency and effectiveness throughout the institution.

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### UB - ICT Strategy
**May 2001**

<table>
<thead>
<tr>
<th>Strategic Objectives</th>
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<tbody>
<tr>
<td>1. Funding and Accountability</td>
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<td>2. Teaching and Learning</td>
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<td>2.1. Classroom transformation</td>
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<td>2.2. E-Learning</td>
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<td>2.3. Access to facilities</td>
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<td>3. Administration and Management</td>
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<td>4. Research</td>
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<td>5. University Library</td>
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<td>6. Internet, E-mail and WWW</td>
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<td>7. University Network</td>
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<td>8. Computers</td>
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<td>8.1. Hardware</td>
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<td>8.2. Software</td>
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<td>8.3. Technical Support</td>
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<td>8.4. Replacement</td>
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<td>9. User Support</td>
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<td>11. Systems and Equipment</td>
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<td>12. IT Training</td>
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<td>13. Business Continuity Plan and Infrastructure Availability</td>
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<td>14. Security</td>
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**On-going Reforms**

- **Univ.**
  - Design of the University Strategic Plan
  - Upgrade of the University Infrastructure

- **Gov.**

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**Figure 5.1.3 - Ongoing processes at UoB, 2001**
Chapter 5 – Assessing the University of Botswana (UoB) - Botswana

At the time of our assessment at UoB, the ICT strategy was still being considered by the appropriate bodies of the university. The situation existing at the time of our assessment and stated in the draft document was characterized by a lack of clear direction, policies and training and by ineffective ICT management, which led to various problems.

These included lack of clearly defined responsibilities for the management of the existing ICT resources across the university; insufficient investment in support services; inadequate funding for development of services so that infrastructure is used ineffectively; lack of definition of service level standards expected by the university; lack of any university policy on ICT purchase and replacement; vulnerable information management due to inefficient backup and security procedures; lack of integration of services and systems; and fragmented databases leading to additional workload for support services.

An additional observation about the ICT strategy relates to the terminology used: the university still uses the term "IT" instead of the term "ICT" which is internationally defined and used worldwide.

In relation to the upgrade of the university infrastructure, under a special investment programme the university of Botswana is obtaining financial resources from the government to increase and improve the university’s physical and technical infrastructures, such as its buildings and equipment.

People

Academic staff, non-academic staff and students of UoB form the university population. The university population can be expressed as follows:

**Number.** 697 academics, of which around 43% are non-Tswana Citizens, and 1547 administrative and non-academic staff (such as executive senior management, senior administrative, secretarial, clerical, technical, security and nursing staff). UoB has 10826 students.

**Education.** All academic staff have a university degree. Around 22% of the non-academic and support staff have a university degree.

**Experience.** The level of experience varies among the academic and non-academic staff. About 82% of the academic staff are experienced. The majority of academic staff have been lecturing for more than 5 years.

**Personnel Turnover.** The staff turnover is stable in some areas, but in others which are very volatile, such as ICT, people leave the university for better salaries.

Situational Factors.

**Specific situational factors.** Culture of the UoB, and the Starting point for ICT.

**Culture.** According to its values chart: “While achieving its vision and fulfilling its mission, the University of Botswana values the following:

- Students, by creating a holistic environment which ensures that learning is their central focus and by establishing and developing a range of learning, social, cultural and recreational opportunities that will facilitate the full realization of their potential for academic and personal growth.
- Academic freedom, by upholding the spirit of free and critical thought and enquiry, through the tolerance of a diversity of beliefs and understanding, as well as the open exchange of ideas and knowledge.
- Academic integrity, expressed in creativity, objective analysis, experimentation, critical appraisal, independent thought, informed debate and intellectual honesty.
- Cultural authenticity, by ensuring the diversity of Botswana's indigenous values and cultural heritage forms an important part of the academic and organizational life of the institution.
- Internationalism, through participation in the global world of scholarship by being receptive and responsive to issues within the international environment as well as the recruitment of an international staff and student body.
Professional and ethical standards, by upholding the highest professional and ethical behaviour and through openness, honesty, tolerance and respect for the individual

- Social responsibility, by promoting an awareness of, and providing leadership in responding to, the issues and problems facing society.
- Equity, by ensuring equal opportunity and non-discrimination on the basis of personal, ethnic, religious, gender or other social characteristics.
- Autonomy as an institution, that is, through its self-governing structures, independent in action while being responsive to societal needs.
- Public accountability, by ensuring transparent decision making and open review as well as the full participation of stakeholders in the development of the institution.
- Productivity, through the setting and rewarding of high standards of performance underpinned by a dedication to quality, efficiency and effectiveness throughout the institution. [UoB2000]

Starting point for ICT. ICT was first used in the 1980s, mainly in administrative systems. Towards the end of the 1990s, the government decided to provide special funding to the university to ensure that each UoB student and academic staff member would have some sort of access to ICT.

Generic situational factors: ICT suppliers’ relationships, and discontinuity of management

Relationships with ICT suppliers. Relationships with suppliers are ad hoc based.

Discontinuity of management. The University of Botswana management is stable. This allows continuity of activities from their inception to realization.

Conclusions
The education and research at UoB covers also the education and research in the area of ICT. In the ongoing internal reforms, the university has drafted its Information Technology Strategy Plan, which includes procedures to be implemented in relation to ICT issues. The ICT policy and strategy draft document covers relevant issues, and try to address the existing problems in relation to ICT management, ICT acquisition, ICT security, ICT use, ICT implementation and ICT services management. Most of the issues outlined in the ICT strategy cannot be judged since implementation has not started. UoB does not have a long experience of applying ICT to support the realization of its main mission.

While struggling to establish a strategic plan, UoB is making a lot of investments in physical and technical infrastructures.

5.2 Subjects and objects for assessment of the entity ICT using the MCM paradigm

In relation to the entity ICT, we focus on the following subjects and objects:
- Complexity factors
- Hardware/software/communication characteristics
- Data set characteristics
- Procedures characteristics

Complexity factors
Quantity. 2027 PCs in 38 computer labs and elsewhere, a number of communication facilities, 27 software programmes such as operating systems and applications software packages are available. ICT within UoB is growing with the increase in new information systems, computer labs and Internet connection points.

Diversity. UoB has various types of ICT components of different makes and origins, which forces the university to have relationships with the suppliers of all these types of ICT components.
**Distribution.** UoB has its ICT dispersed over its different locations. The main concentration is at the Gaborone main campus.

**Dynamics.** Changes in hardware and software take place slowly. The staff of the UoB Computer Centre, faculty staff members and staff of ICT suppliers introduce changes to hardware and software. Changes are not controlled; they happen on an ad hoc basis.

**Functionality.** ICT is employed for different functions within UoB.

**Relationships.** The existing ICT is networked but linkages to the administrative systems have not been made.

**Ownership.** The university owns the ICT. The Vice Chancellor has delegated some of her responsibilities to the heads of academic and administrative units. The delegation of responsibilities also includes delegation of responsibilities for ICT allocated to them.

**Utilization.** The respective users utilize the ICT available in each academic or administrative unit. There is however a difference in access and utilization between academic staff and students, on the one hand, and administrative staff, on the other. The academic staff and students use the available ICT freely for their particular individual needs, whilst the administrative staff are more tied to applying ICT for specific tasks. For example the Human Resource Directorate staff can only use ICT in the Human Resources Management Information System.

**Sophistication.** The university’s ICT is very advanced. However, most university staff members have insufficient knowledge of the available ICT, which makes it difficult for them to use and/or service such sophisticated ICT properly.

To illustrate the complexity of the university’s ICT we refer to Figure 5.2.1, which shows the variety/diversity in communication facilities. Table 5.2.1 gives information about the capacity of these communication facilities.

<table>
<thead>
<tr>
<th>Type</th>
<th>Topology</th>
<th>Capacity</th>
<th>Beneficiary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Backbone</strong></td>
<td>Fibre</td>
<td>1 GB Links</td>
<td>University Community</td>
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<td></td>
<td></td>
<td>100 MB Links</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>10 MB Links</td>
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<tr>
<td><strong>Local Area Networks</strong></td>
<td>CAT 5E</td>
<td>10/100 MB</td>
<td>University Community</td>
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<td>Ethernet</td>
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<tr>
<td><strong>Metropolitan Network</strong></td>
<td>CAT 5E</td>
<td>10/100 MB</td>
<td>University Community</td>
</tr>
<tr>
<td></td>
<td>Ethernet</td>
<td></td>
<td></td>
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<tr>
<td><strong>Wide Area Network</strong></td>
<td>Leased Line</td>
<td>64MB Link, 128 MB Link</td>
<td>University Community &amp; Branches</td>
</tr>
<tr>
<td><strong>Wireless Technology</strong></td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Internet</strong></td>
<td>Leased Line</td>
<td>1MB</td>
<td>University Community &amp; Branches</td>
</tr>
</tbody>
</table>

Table 5.2.1 - UoB Networking Infrastructure, 2001

**Hardware/software/communication characteristics, such as:**

**Network capacity.** The ICT at the main campus consists of a number of LANs (Ethernet 10 Mbps) dispersed over the buildings of the campus. The ICT for each building is connected with concentrated computing facilities by fibre optic cable. This creates a mesh network topology, combining a fibre bus and star in the buildings. For each building with up to 40 people, 10 Mbps are made available, while for more than 40 people, 100 Mbps is implemented. Student hostels are also part of the network. The university is linked to the Internet via a 1Mbps line leased from the Botswana Telecommunications Corporation (BTC). There are several ISPs in Botswana. The two main ISPs in the capital Gaborone are BOTSNET (a subsidiary of BTC, the main bandwidth provider), and INFOBOTSWANA.
Figure 5.2.1 - University of Botswana ICT Infrastructure, 2001
Standardization. There is no ICT standardization policy.
Quality of technical facilities. The technical ICT components are of high quality.

Data set characteristics, such as:
Extent. The existing databases are of small and medium size. Faculties keep small databases generated from research activities and administrative units keep medium-size DBMS for the databases of the Finance Information System, Student Records Information System, Payroll and Personnel Information System, and the Library Information System.
Standardization. Each information system has its own database structure. Standardization of databases is at a low level.
Database Management Software. Oracle, Informix and Access database management software are applied within UoB.

Procedures characteristics, such as:
Number. The total number of procedures is not known.
Extent. Procedures are based on practices. Few are written down.
User friendliness. The procedures are said to be user friendly.
Language. The existing procedures are mainly written in English, the official language. Technical documentation is also written in English.

Conclusions
UoB has a very extensive ICT infrastructure and many components. The available ICT is of several types and from different manufacturers and origins. A good understanding of this highly complex ICT infrastructure is required, and so are well-defined user groups. UoB also needs a professional ICT service management to support the implementation and utilization of the ICT in accordance with the requirements, pre-conditions and situational factors of the university so as to influence its core business in a positive way. Relationships with suppliers are generally conducted on an ad-hoc basis.

5.3 Subjects and objects for assessment of the entity MCM using the MCM paradigm

In relation to the entity MCM we focus on the following subjects and objects:
- Organization
- Tasks with reference to tasks areas and task fields
- Processes
- Procedures
- People

Organization
The Management, Control and Maintenance of the ICT supporting the University of Botswana is mainly centralized at the Computer Centre. Some faculties, such as the Faculty of Science and the Faculty of Engineering and external ICT services such as the national post and telecommunications organization, the electricity company, the Internet suppliers and ICT consultants also undertake MCM activities.

The university’s Computer Centre (CC) is a service provision unit in the area of ICT; it supports both the academic and administrative activities of the university. The university’s draft strategy has set out requirements and pre-conditions for the relations between the CC and the rest of the university. These requirements have been discussed with the entire university community. At the time of research, however, the IT strategy was still awaiting the University Council’s approval.

Within the Computer Centre, activities are undertaken through specialized units and staff as indicated in Figure 5.3.1
The 26 staff of CC perform MCM functions within the following sectors:

- System Management (SM): With a system analyst, system programmer and Web administrator, this sector is responsible for designing new software applications, making adjustments to the existing software applications and designing and maintaining Web pages for the whole university.
- Networking and LAN (NLAN): With network management, LAN administration and supervision, this sector deals with the planning, implementation and maintenance of the UoB Network and LANs. It also covers testing and replacement of defective components of the network and of the LAN. Addition of new components to the network or LAN is also handled by this sector.
- Database Management (DM): This sector is responsible for database development and administration of the database management systems.
- Training (TR): This sector provides end-user training in general application software packages such as Word, Access, Power Point. It also provides Internet and Web design courses for users, managers and technicians;
- User Support (US): This sector deals with computer hardware planning, testing, installation and maintenance. US activities include hardware repair, both for stand alone and networked computers.

![Diagram of University Computer Centre Organization Chart]

The Director of the Computer Centre is sometimes involved in technical activities as well as administrative ones. He is supported by a deputy director with DBA (Data Base Administrator) experience, technicians, a network manager and other professionals, including the Web administrator, analyst/programmer, database assistant and assistant user support managers, in total 26 staff members. At the time of assessment, the Computer Centre was in the process of recruiting the following additional staff: a LAN administrator, programmer,
database manager, database developer, user support manager, training manager and systems manager.

**Tasks**
According to the summary of the MCM paradigm and the Three Kinds of MCM/Expansion models presented in Chapter 4, management tasks can be found and performed within the MCM entity of the MCM paradigm and within the three kinds of MCM, forming Functional Management (FM), Application Management (AM) and Technical Management (TM). In the MCM entity, such tasks are realized in more than one organization. Within UoB, the CC, with a certain level of organization and some experience, performs most of the TM. AM and FM are weakly performed. Section 5.7 will describe all tasks and organizations performing them in more detail, by using the model Three Kinds of MCM.

**Processes**

**Incident Management.** Incidents are logged into the existing Helpdesk. The Helpdesk is located at the Computer Centre. The centre deploys staff to faculties and to the library to provide the first line of support. However, major technical problems are usually escalated to the centre if they cannot be resolved from the faculties or the library. If the centre cannot resolve problems it engages the services of vendors or suppliers. In general most of the incidents reported are cleared. Solutions provided are not always recorded.

**Problem Management.** The Computer Centre staff, without recognizing it as such, carries out some form of problem management. In general problems are solved but without going to the root cause of the problem, and as a result the problem often recurs sometime after repair. Therefore problem management is not dealt with professionally.

**Change Management.** New ICT is acquired and as consequence some form of change management takes place. The Computer Centre staff, faculty staff members, and ICT suppliers perform some change management on an ad hoc basis. It is not formalized.

**Configuration Management.** Occasional inventory of ICT, which serves as configuration management mainly for hardware, takes place as part of the general procedures of the university to keep track of all university assets. A Computer Services Committee has been set up to take responsibility for major ICT procurement and policies related to the acquisition and utilization of ICT. This committee is composed of faculty representatives and is headed by a staff member from the Department of Computer Science. The Director of the Computer Centre is the secretary of this committee. Faculties, administrative units and the CC can, however, all obtain hardware, software and services without passing the proposal through the Computer Services Committee. This makes it difficult to maintain a university-wide ICT inventory.

**Release Management.** No release management takes place

**SLA Management.** Service Level Agreement Management is very low. SLAs are not formalized in agreements with UoB entities. The ICT strategic plan identifies projects and new services to be implemented annually and defines the quality of service the Computer Centre expects to provide. The plan is communicated to the stakeholders and acts as a service level agreement between the consumer of services and the Computer Centre.

**Capacity Management.** Faculties and the Computer Centre perform some capacity management on an ad-hoc basis.

**Contingency Management.** No contingency management is performed. Emergencies can be dealt with easily, however.

**Availability Management.** Some sort of availability management exists.

**Cost Management.** Some sort of cost management is done.

**Network Services Management.** The Computer Centre performs network services management together with the external ICT service suppliers
Chapter 5 – Assessing the University of Botswana (UoB) - Botswana

Procedures in written form, verbal form
Most of the procedures for the realization of MCM tasks are not written down. The support documentation consists mainly of the technical and user manuals/documents supplied with hardware and software and written in English.

People
Number. Around 35 people from CC, faculties, and external ICT suppliers realize MCM tasks in one way or another.
Education. About 4 staff realizing MCM tasks have some understanding of these tasks and the majority is with the Computer Centre.
Experience. 2 staff dealing with MCM tasks have many years of working experience in their field of ICT operation. This number is insufficient to handle all the necessary service management professionally.
Personnel Turnover. University staff with MCM skills can easily get well-paid jobs outside the university. With the exception of the most experienced Computer Centre staff member (the Director), staff generally leave the university as soon as they have enough experience and have done a certain number of ICT courses.

Conclusions
The MCM at UoB is centralized at the Computer Centre, which therefore plays an important role in the realization of MCM tasks, together with external ICT service suppliers. Some faculties also perform some MCM tasks. MCM processes are not well covered by the CC and the other organizations involved. The ones that are carried out are not done at an appropriate level. SLAs are not formalized and few procedures are in written form; most of them are orally stated. Thus, ICT service management still leaves out many MCM tasks which need to be carried out systematically and professionally in order to constitute a positive input to the university.

5.4 Subjects and objects for assessment of internal relationships using the MCM paradigm

In relation to the internal relationships we focus on the following subjects and objects for assessment

Relation RS → ICT. Requirements and preconditions
The university exploits for its own benefit a software package called ITS (covering modules such as the student management information system, the payroll and human resources information system, the finance information system, the clinic information system, asset management information system, meals point of sale and the book shop information systems), the INNOPAC library information system, and the university computer network. Requirements and preconditions for this ICT have been formulated. While financial resources are not the major block to the modernization called for in the university ICT strategy, significant barriers are constituted by the lack of infrastructure throughout the country, lack of broad understanding of the implications of implementing and maintaining information systems and lack of skilled human resources.

Relation RS ← ICT. Way of support
The student management information system, the payroll and human resources information system, the finance information system, the clinic information system, asset management information system, meals point of sale and the book shop information systems, the INNOPAC library information system and the university computers network support the university in its activities in relation to students, staff, finances, education and research. The massive deployment of computers to all workstations, including at students’ desks, has not succeeded in enabling the university to get the best out of the available ICT, as training programmes have not kept pace with the deployment of hardware and so students and faculties are not equipped with enough knowledge to make full use of the available ICT.
Relation ICT → MCM. Kind of data to support MCM
The student management information system, the payroll and human resources information system, the finance information system, the clinic information system, asset management information system, meals point of sale and the bookshop information systems, the INNOPAC library information system, and the university computer network support the technical staff of the Computer Centre and ICT service suppliers by supplying them with data. Decision making is not commensurate with the speed at which ICT delivers information to management. There is room for a clear definition of the data needed by the computer centre in order to improve ICT management tasks.

Relation ICT ← MCM. Way of management
Technical staff of the Computer Centre and from ICT service suppliers provide support to the university’s available ICT in collaboration with the user departments of the student management information system, the payroll and human resources information system, the finance information system, the clinic information system, asset management information system, meals point of sale and the bookshop information systems, the INNOPAC library information system, and the university computer network. Nevertheless, for three reasons, situations might be created where decisions cannot be supported by the data provided: many management tasks are not realized; for those which are realised, it is not clear who is responsible; and the available data supplied by ITC can be interpreted only to a limited extent.

Relation RS → MCM. Requirements and preconditions
The university employs Computer Centre technical staff to manage the student management information system, the payroll and human resources information system, the finance information system, the clinic information system, asset management information system, meals point of sale and the bookshop information systems, the INNOPAC library information system, and the university computer network. In this relationship the university has not established detailed Service Level Agreements (SLAs) in which requirements and preconditions to be fulfilled by CC are stated. The university’s annual ICT annual plan, drawn from the draft ICT strategy, serves as an SLA between the user departments and the CC. Of course it serves only as a general guideline for the whole university and is not related to individual relationships between user departments and ICT service suppliers. At the time we assessed the UoB, the university was in the process of defining the quality of services that the computer centre is expected to provide. It is expected that as soon as such definitions have been decided upon, these will serve as a type of service level agreement.

Relation RS ← MCM. Way of support
Technical staff of the CC respond to requests from users within the university. There is no SLA governing such requests. The mandate of the CC is not clear. User units are not bound by the SLAs drafted by the CC. CC staff respond to the request as part of their duties as employees of the university. Although financial resources have not been a major problem so far, delays in decision-making and the lack of staff skilled in ICT management make it difficult to implement appropriate management and maintenance tasks promptly. Also, given the dispersal of support responsibilities, it is not always easy for university departments to establish the procedures that lead to solution of an ICT problem.

Conclusions
The university has formulated requirements and preconditions for the existing ICT. Areas covered by ICT support are clearly defined. Lack of skills at the user side prevents proper utilization of ICT, so that the university cannot get the best out of it. The shortage of qualified people who understand the sophisticated ICT also prevents units that perform MCM tasks related to Application Management and Technical Management from taking timely decisions based on the data generated by the ICT. UoB has not established formalized service level agreements with parties employed by the university to perform MCM tasks. Requests made for ICT services are handled on an ad hoc basis.
5.5 Subjects and objects for assessment of the external influences using the MCM paradigm

Economy
Botswana is one of the few African nations with a favourable balance of payment. As of 1997, the country had a foreign reserve of US$5.7 billion. The annual growth rate of GNP was 4.7% in 1998-99 [ACR2000]. However, Botswana is overburdened with institutional structures to the point where delivery of services has become lethargic. The process of issuing licenses and permits is generally above board and conducted ethically, creating an attractive environment for investors in general, particularly in the area of ICT. The economy of Botswana is rated as good [ACR2000] and therefore the government provides sufficient funds to the University of Botswana for its ICT needs. UoB does not depend on donors for the implementation of its ICT programmes.

Education
Botswana is a large, sparsely populated country, with a rate of population increase of 2.4% per annum, lower than in most of Sub-Saharan Africa [ACR2000]. Thus the labour force is small and dispersed. Many skilled and educated workers migrate to South Africa and the few remaining educated workers cannot satisfy the needs of the economy of Botswana.

Furthermore, the introduction of ICT as a discipline in schools has been slow. Secondary schools have recently started using ICT, in a limited way, to support other disciplines. Therefore the ICT skills of the students entering UoB are very limited, or non-existent and qualified human resources in the ICT field are correspondingly scarce.

The UoB strives to keep the qualified staff that it trains, but the market outside the university pays more and thus attracts many qualified staff. Staff working in the ICT field has been trained both in Botswana and outside (America, Europe, Africa, Asia) in courses providing various levels and types of skills, leading sometimes to an imbalance between the types of skills acquired and the skills which are needed. Botswana has visiting lecturers from outside the country teaching ICT at schools and at the university, where each one teaches from the point of view of his/her own culture. Although this diversity may be considered advantageous, it can also lead to those trained having difficulties in applying their new skills and knowledge to the real conditions in the university.

Governance
The President of the Republic of Botswana, who is the Chancellor, maintains the relationship between UoB and the government. The Council is the governing body of the university, and has the ultimate responsibility for the work and progress of the university towards the achievement of its goals. The Council has wide powers to make statutes, lay down policy, approve programmes and plans, and to establish working procedures governing the organizational life of the university. It also provides and controls the resources required to support both the academic activities and the physical development and maintenance of the university. Financial resources are provided to the council by the government through the Ministry of Finance, to which the university is accountable in this matter, as indicated in the Act of Parliament of 1st July of 1982 establishing the university. On a daily basis the university is run by the Vice Chancellor, who is accountable to the council. The governance structure of the UoB is not greatly influenced by the sitting government.

Donors
UoB gets its financial resources from the Government of Botswana. The contribution of donors to its budget is limited to small projects and donors do not significantly influence the ICT activities at UoB.

ICT suppliers
The major brand names of European, American and Asian hardware, software and communication infrastructures can be found at UoB. The ICT industry in Botswana is still in
its infant stage. Little software is produced locally. No hardware is produced in the country. Dealers exist and their main suppliers are South African or British-based companies. These, in turn, source ICT from other markets. Few of the dealers offer after-sales services, but if they do, these are in general rated as good. This gives the university the confidence to acquire hardware and software locally.

The Botswana Telecommunication Corporation (BTC) is a partially state-owned enterprise. BTC has established digital state-of-the-art technology. Its network is composed of an all-digital microwave and fibre optic system with digital exchange at the main centres, and provides high-quality services. International access is provided from Botswana to almost every country in the world.

The government is in the process of privatizing the mobile telecom services. Two private mobile-phone operators have been awarded mobile licenses: Vista Cellular (owned by France Telecom and Botswana Investors), and Mascom Wireless (owned by Portugal Telecom - 25%, Mascom Wireless - 32% and Botswana corporate investors - 43%). The Botswana Telecommunications Authority has also issued licences to several other companies to provide data services including VSAT [BMI2000].

Conclusions
The relative stability of the economy of Botswana is positively influencing the financial situation of UoB in financing its programmes and activities. Nevertheless the university still lacks enough qualified staff. To minimize this problem, which is also a problem in the country as a whole, the university on the one hand sends its staff abroad for post-graduate programmes, and on the other it recruits non-Botswana citizens as staff.

Being a public university, UoB is governed by civil service rules. However, it maintains its autonomy as defined in its statutes.

Many major brand names of European, American and Asian hardware, software and communication technologies can be found at UoB and in Botswana in general. Due to the available financial resources, many suppliers may try to sell the most advanced ICT to UoB even if UoB cannot exploit it at the desired levels because of its shortage of staff with skills to do so.

5.6 Subjects and objects for assessment using the State Model/ Extended State Model

State Model/Extended State Model subjects and objects
- University Network. (State(s) and tasks and processes)
- Local Area Networks. (State(s) and tasks and processes)
- General Information Systems

University Network
The implementation of the UoB network is underway. At the same time as it is being utilized, the UoB network is subject to various modifications, mainly to increase bandwidth, to introduce high-performance hardware and software, and to establish more Internet services and more Internet access points through the university campuses. In the Extended State Model, the UoB network can be said to be in the utilization state, the maintenance/modifications state and the exploitation state. Its utilization is affected by low international bandwidth for the Internet.

Local Area Networks
Concerning the Local Area Networks, the Planning State has been passed for most of the buildings. In the majority of buildings (around 90%), LANs have been acquired/developed and implemented. In these buildings the LANs are in the U, M1/M2 and E States.
Chapter 5 – Assessing the University of Botswana (UoB) - Botswana

Modifications are more often done than Maintenance. In the remaining 10%, LANs are in the Acquisition/Development State.

General Information Systems
The university is using a software package called Integrated Tertiary Software, developed by a company of the same name. This package runs on a UNIX operating system and comprehends a number of modules, of which UoB is using the Payroll and Personnel Information System, Student Records Information System and Finance Information System.

Payroll and Personnel Information System
The Payroll and Personnel Information System is in the States U, M1/M2, and E.
In the Utilization State, the Payroll and Personnel Information system, on an Oracle database, is accessed and manipulated using the ITS management information system. The systems and the operating system have been configured for an unlimited number of users. The Finance Directorate runs the Payroll subsystem, and the Human Resources Directorate runs the human resources management subsystem in which activities such as data on new staff and staff absence are entered. This data is then used by the payroll subsystem. In the M1/M2 state, the ICT services supplier (the company ITS) is asked by the Directorate of Human Resources to introduce new functionalities. The M1/M2 State is not frequently undertaken. In the Extended State model, all states are clearly defined and they are to be undertaken separately. This is what is generally done at UoB. As part of the Extended State Model, UoB has extended its ITS services to include the clinic system, asset management, meals point-of-sale and the bookshop. The university is also in the process of providing online access to financial information and related information to students via an inquiry system.

Student Records Information System
The Student Records Information System is in the States U, M1/M2 and E.
Student records are held in an Oracle database, and are accessed and manipulated using ITS management information system. The systems and the operating system have been configured for an unlimited number of users. In the Utilization State, the Academic Registry Directorate runs activities such as entering data on new students, academic performance and new courses. The Academic Registry Directorate then makes use of that data to produce information for various entities such as the top management of the university, the faculties and students. In the M1/M2 state, the supplier (ITS) is asked from time to time by the Academic Registry Directorate to introduce new functionalities. Such requests are not frequent. In the Extended State Model, all states are clearly defined and they are to be undertaken separately. Although modifications are not frequent, the combination of the two states creates an opportunity for conflicts between users and developers and creates lack of confidence in users. At the time of the assessment of UoB, the university was implementing an online application and registration system through the web.

Finance Information System
The Finance Information System is in the U, M1/M2, and E States.
In the Utilization State, the Finance Directorate runs activities such as accounting and entering and controlling of budget data. This data is then used by the directorate to produce financial information for the university’s top management and academic and administrative units, government bodies and donors. In the M1/M2 State, the ICT service supplier (ITS) is asked by the Directorate Finance to introduce new functionalities.
The university is also in the process of providing online access to financial and related information to students via an inquiry system. At the time of this research, the university was also assessing the feasibility of extending access to the finance management information system to academic staff.
In the Extended State Model all states are clearly defined and they are to be undertaken separately. What is happening with the Finance Information System is in conflict with the Extended State Model because the two states exist at the same time. The combination of the two states creates an opportunity for conflicts between users and developers and creates lack of confidence on the part of users.

**Library Information System**
The Library Information System is in the U, M1/M2, and E States.
In the Utilization State, the UoB library operates an online catalogue system called INNOPAC supplied by Innovative Interfaces Incorporated. The system provides online catalogue services to clients through a Telnet interface and a Web interface. In the background it manages acquisition, processing and circulation of library materials. The system maintains a database of materials held by the main library and the branch libraries, Francistown CCE and the Faculty of Engineering library. The catalogue is accessible throughout the campus LAN and also over the Internet from external sites.
From time to time the ICT service supplier Innovative Interfaces Inc. is asked by the University of Botswana Library to introduce Modifications and carry out Maintenance. Maintenance, which is affected by the level of usage and the lack of in-house technical support, is more often done than Modifications. The two States U and M1/M2 are implemented separately.

**ICT-based distance education**
There are no activities in this area.

**University Management Information System**
The university has no MIS.

**Conclusions**
The UoB network, which constitutes a centrally planned, developed/acquired, implemented and managed ICT infrastructure, is now in the Utilization State. Growth was foreseen during the planning phase. Modifications are taking place to accommodate new technologies, to improve existing ones, and to provide more Internet access points. The majority of planned LANs in different buildings of UoB have been implemented and are in use.

ICT suppliers are establishing information systems for general use. The UoB has adopted a one-supplier approach, as a result of which UoB is dependent on one ICT supplier for its general administration software and hardware. In general the procedures for the implemented general information system are not in conflict with the Extended State Model, since ITS comes and installs the software and hardware and then leaves, only returning when maintenance or modifications are needed. The process of making decisions on the implementation of new systems is slow. UoB suffers from lack of skilled staff to run the newly acquired information systems.

**5.7 Subjects and objects for assessment using the Three Kinds of MCM Model and the Expansion of the Three Kinds of MCM Model**

**5.7.1 Functional Management (FM)**

**Organization**
Functional Management tasks at UoB are undertaken mainly by the Computer Centre, and also by some faculties and administrative units. The decentralization processes implemented within the university include the decentralization of management tasks related to ICT. As a result the Functional Management is performed in university units owning ICT. Users perform Functional Management with the support of Computer Centre staff and staff of ICT suppliers. Tasks related to FM are not fully implemented however.
Chapter 5 – Assessing the University of Botswana (UoB) - Botswana

Tasks
Table 5.7.1 provides an overview of tasks undertaken by the different parties involved in FM tasks. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

<table>
<thead>
<tr>
<th>Task Areas/Task Fields</th>
<th>University Computer Centre (CC)</th>
<th>Faculties and Administrative Units</th>
<th>External ICT Service Suppliers</th>
<th>ICT Consultants</th>
<th>University Top Management</th>
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<td>Strategic Management (SM)</td>
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<td>• Communication Support</td>
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<td>• DBMS support</td>
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<td>• Management of (PC) application packages</td>
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<td>• Research</td>
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<td>• Management of technical and communication facilities</td>
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<td>General Business Support (GBS)</td>
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<td>• Order Control</td>
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<td>• Acquisition of ICT Resources</td>
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<td>Operational Management (OM)</td>
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<td>• Data Definition Control</td>
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</table>

Table 5.7.1 - Functional Management tasks undertaken by the different parties at UoB.

Processes
Processes related to FM are mainly undertaken by the CC. Such processes were presented in Section 5.3, where the MCM entity was presented.

Procedures
Procedures for the realization of tasks are occasionally formulated and written down. The implementation of procedures is ad hoc and the procedures are not rigorously followed and controlled.

People
Number: a very limited number of staff (about 30) realize FM tasks in one way or another.
Chapter 5 – Assessing the University of Botswana (UoB) - Botswana

**Education:** about 10% of staff realizing FM tasks have some understanding of them, mostly in the CC.

**Experience:** about 20% of staff dealing with FM tasks have many years of working experience in their field of ICT operation.

**Personnel Turnover:** People qualified in ICT can easily get jobs outside the university. As soon as staff have acquired enough working experience, they tend to leave the university for well-paid jobs elsewhere.

### 5.7.2 Application Management (AM)

**Organization**
Application Management at UoB is undertaken mainly by the Computer Centre and some ICT service suppliers; some faculties and administrative units and consultants are also involved in AM. It is mainly the users who perform Application Management tasks, but the staff of software application suppliers also perform these, mostly from outside Botswana. The units involved in the AM tasks are: the Computer Centre, faculties and administrative units, external ICT service suppliers and ICT consultants.

**Tasks**
Table 5.7.2 provides an overview of tasks undertaken by the different parties involved in AM tasks. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

<table>
<thead>
<tr>
<th>Task Areas/Task Fields</th>
<th>University Computer Centre (CC)</th>
<th>Faculties and Administrative Units</th>
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<td>Operational Management (OM)</td>
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</table>

Table 5.7.2 - Application Management tasks undertaken by the different parties at UoB

**Processes**
Processes related to AM are mainly undertaken by CC. Such processes were presented in section 5.3, where the MCM entity was presented.
Chapter 5 – Assessing the University of Botswana (UoB) - Botswana

Procedures
Procedures for the realization of AM are normally not written down. Even if they are, they are not rigidly followed.

People
Number: Around 15 people are involved in AM
Education: 60% of staff involved in AM have a university degree. 20% of staff involved in AM have followed some sort of ICT course.
Experience: Most of the staff involved with AM have more than five years of working experience.
Personnel turnover: University staff involved in AM can easily get jobs outside university and it is difficult to retain staff.

5.7.3. Technical Management (TM)

Organization
Technical Management is performed in more than one unit within the university. ICT suppliers from outside the university also perform TM. The following units are involved in TM: the Computer Centre, some university computer labs belonging to faculties such as Engineering. In the Faculties, basic TM tasks are realized, but complex TM tasks are directed to the Computer Centre and hardware, software and communications suppliers.

Tasks
Table 5.7.3 provides an overview of tasks undertaken by the different parties involved in common TM. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

Processes
Processes related to TM are mainly undertaken by CC. Such processes were presented in section 5.3, where the MCM entity was presented.

Procedures
Procedures for realization of TM tasks are not rigorously applied/realized. A limited number of procedures are set down in writing.

People
Number: a very limited number of staff, about 30, perform TM tasks in one way or another.
Education: around 10% of staff realizing TM tasks have some understanding of them, mostly in the CC
Experience: around 20% of staff dealing with TM tasks have many years of working experience in their field of ICT operation.
Personnel Turnover: People qualified in ICT can easily get jobs outside the university. The trend is for ICT staff to leave the university for these jobs.
<table>
<thead>
<tr>
<th>Task Areas/ Task Fields</th>
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<td>Software Support</td>
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<td>- Communication Support</td>
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<td>- DBMS support</td>
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<td>- Management of (PC) application packages</td>
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<tr>
<td>- Research</td>
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<tr>
<td>- Management of technical and communication facilities</td>
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<tr>
<td>Personal Management</td>
<td>✓</td>
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<tr>
<td>- Personal Management</td>
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<tr>
<td>General Business Support (GBS)</td>
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<tr>
<td>- Administrative Management</td>
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<tr>
<td>- Quality Control</td>
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<td>- Capacity Planning</td>
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<td>- Order Control</td>
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<tr>
<td>- Budgeting</td>
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<tr>
<td>- Charging Back</td>
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<tr>
<td>- Acquisition of ICT Resources</td>
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<tr>
<td>Operational Management (OM)</td>
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<tr>
<td>Maintenance Technical Infrastructure and Operational Support (MTI-OIS)</td>
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<tr>
<td>- Changing Technical Infrastructure</td>
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<tr>
<td>- Problem Management</td>
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<tr>
<td>- Availability Control</td>
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<tr>
<td>- Disaster Recovery</td>
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<td>- Security</td>
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<td>Operational Control</td>
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<tr>
<td>- Acceptance</td>
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<td>- Operating</td>
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<tr>
<td>- Hardware Configuration Management</td>
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<td>- Software Configuration Management</td>
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<tr>
<td>- Physical Data Management</td>
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<tr>
<td>- Utilization Analysis</td>
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<tr>
<td>- Performance Management</td>
<td></td>
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<tr>
<td>- Tuning</td>
<td></td>
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<tr>
<td>Technical Services (TSe)</td>
<td></td>
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<tr>
<td>- Management of the Range and Cost of Services</td>
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<tr>
<td>- Data Processing</td>
<td></td>
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<tr>
<td>- Advice and Participation</td>
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<tr>
<td>- Information Supply</td>
<td></td>
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</tbody>
</table>

Table 5.7.3 - Technical Management tasks undertaken by the different parties at UoB.

Conclusions
Although they are not recognized as such, tasks related to the three kinds of MCM are realized in one way or another within the university. The level of skills available for these tasks is generally very low, and the few skilled staff have acquired knowledge through short ICT courses. However, qualified staff tend to leave the university for better-paid jobs. The (✓)s in the three tables may suggest that all tasks are fully performed, but in fact the tasks are
performed at a very low level. Many tasks which are part of the realization of the FM, AM, TM are not carried out. There is no clear demarcation of responsibilities among the parties involved. In all three kinds of MCM, the Computer Centre plays a major role. Realization of tasks and processes is not formalized. They are performed in an ad hoc manner.

The education system in Botswana does not offer ICT management courses in which skills in different types of management can be developed.

5.8 Drawing conclusions for the Big ICT Five

For the overall assessment of UoB we formulate the following conclusions in relation to ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization, and ICT service management:

Concerning ICT - Strategy
UoB has decided to develop an ICT strategy to address strategic ICT issues, such as lack of clearly defined responsibilities for the management of its ICT resources, insufficient investment in ICT support, lack of definition of the service level standards expected by the university, and vulnerability in procedures for ICT security. The first ICT strategy was drafted in May 2001 and is now awaiting approval by the University Council. The main part of the ICT strategy concerns relevant strategic subjects for consideration within the university, such as ICT funding and accountability, ICT utilization for teaching and learning (classroom transformation and e-learning), access to Internet and Internet services, ICT utilization, ICT technical support and ICT security. However, other relevant ICT strategic subjects are not clearly presented in the strategy, although they are covered in the policy document. These include ICT service management and ICT knowledge development for both users and for developing technical and managerial skills of university staff (UoB considers this to be covered by the Policy document). In the draft ICT strategy there are policies that are meant to provide responses on how the strategic issues would be addressed. However, in the document, the concepts of strategy and policy are mixed up and 'IT strategy' is discussed without reference to ICT (as it is known worldwide). Moreover, it is difficult to assess the impact of the draft ICT strategy because it has not been approved.

Concerning ICT – Acquisition/Development
Some time ago the university decided to acquire information systems packages developed elsewhere rather than developing them in-house, for several reasons. First, the university lacked an asset management policy for the purchase and replacement of ICT resources sufficient to maintain the ICT infrastructure. Secondly, services and systems are not well integrated but are characterized by fragmented databases, leading to additional support load. Thirdly, there is a shortage of human resources for developing information systems.

The university-wide ICT network has also been planned and established by acquiring services from outside for both its design and implementation.

In all cases requests for proposals are preceded by a set of technical specifications and the definition of system functionality specified by the university with the aid of ICT consultants. Customization and implementation requirements are assessed once responses to the RFPs have been received. The fact that the Director of the CC is a member of the acquisition committee means that he is aware of decisions on acquisitions, whether made using university funds or by donors. However, in donations there may be problems of standardization, given that the academic units are able to decide what they would like, regardless of the orientations of the CC.

Concerning ICT - Implementation
ICT implementation is undertaken by teams made up of staff from the CC, faculties and ICT suppliers, so that the CC should be aware of what is being implemented. Nevertheless, project management procedures are not always rigorously applied, thus jeopardising the potential
benefits of ICT implementation for the university. ICT implementation may ignore strategic issues such as prior definition of service level agreements with the CC and ICT service suppliers. In some cases, suppliers come into the university without the CC’s knowledge; yet when problems arise, the CC is called upon to solve them.

Concerning ICT - Utilization
The utilization of ICT is mainly PC oriented, although multi-user systems are in place for the administration of the academic processes, educational programmes and administrative processes. 38 computer laboratories are available to serve students and academic staff. These are the areas of most concentrated ICT use. ICT utilization is not optimal, however. Not all the academics, administrative staff and students know how to get the best out of the available ICT. The relative stability of the economy of Botswana allows the government to provide financial resources for ICT acquisition. However, it is not clear what follows after capital investments, and whether users are aware of the different components of costs of ICT.

Concerning ICT - Service Management
ICT service management is mainly centralized at the Computer Centre and ICT service suppliers, although some faculties such as Engineering and Science attempt to support their own ICT up to a certain level. No formal procedures for support to the utilization of ICT have been agreed among the Computer Centre, ICT service suppliers, faculties and administrative units. Although Service Level Agreements with the user departments may not be available, there are structures in place of these. The Director of the CC, for instance, has to submit projects that are planned for the year. This forms part of the contract which the CC signs with the university about what projects are to be undertaken, what level of quality is to be expected, and what improvements or new technology is to be implemented. Procedures for service delivery, user groups relationships, management of various components of ICT costs may however be lacking.

Management of services provided by suppliers is governed by contracts. The services offered by suppliers sometimes do not include realization of management tasks at the appropriate level, following defined procedures with periodic reviews.
University of Dar-es-Salaam (UDSM)

Information about UDSM was obtained from UDSM annual reports, strategic plan, other publications, www.udsm.ac.tz and field assessment, and was verified by the Director of the Computer Centre.

Tanzania
6. ASSESSING THE UNIVERSITY OF DAR ES SALAAM (UDSM) TANZANIA

Introduction
The objective is to assess the Big ICT Five in the University of Dar Es Salaam (UDSM) by applying the models presented in Chapter 4. For the assessment, we will follow the outline presented in Section 4.3 of Chapter 4.

6.1 Subjects and objects for assessment of the entity Real System using the MCM paradigm

In relation to the entity Real System, we formulate the following subjects and objects:
- Historical Background
- Location
- Organization
- Services
- Administration supporting education, research, and services
- People
- Situational Factors

Historical background
The University of Dar Es Salaam (UDSM) was started as a college of the University of London in 1961 with only one faculty, the Faculty of Law and with an initial enrolment of 13 students only. In 1963 it became a constituent college of the University of East Africa that included the University College of Nairobi in Kenya and that of Makerere in Uganda. On 25th March, 1970, the University of East Africa was split into three independent Universities, namely the Universities of Makerere, Nairobi and Dar Es Salaam.

To maintain East African inter-university academic co-operation and communication, the Inter-University Council for East Africa was set up in 1970. The Council established an Inter-University Exchange Programme, through which UDSM can admit students from other East African countries, mainly Kenya and Uganda. The university also admits students from several other countries across the world through established links, exchange programmes or individual applications. Most of these students receive their bursaries from their respective governments. Students from other countries are considered for admission to both undergraduate and postgraduate studies, subject to the availability of vacancies.

Location
The university is situated on the west side of the city of Dar Es Salaam, occupying 1,625 acres on Observation Hill, 13 km from the centre of the city and approximately 15 km from Dar Es Salaam international airport.

Organization
Organization structure. The organizational structure of UDSM can be fitted into the Mintzberg logo, as illustrated in Figure 6.1.1.

Education and Research. Education and Research activities are undertaken within faculties/departments and research and service centres, colleges, and institutes. In relation to education and research in the area of ICT, the Faculty of Science offers computer science courses. The Engineering Faculty offers Electrical Engineering courses. The curriculum of the Electrical Engineering course includes ICT-related disciplines. None of the faculties provides ICT management courses. Research undertaken by the university aims to support education in the form of the teaching and learning activities for graduate and post-graduate programmes, and applied research to support development programmes, such as design of new agricultural instruments and production of new types of pest-control products/chemicals to reduce crop loss.
The academic and non-academic staff directly involved in teaching-learning, research and extension services is attached to faculties, colleges and institutes identified in Table 6.1.1.

<table>
<thead>
<tr>
<th>Faculties (F1 – F5), Institutes and other units</th>
<th>Courses</th>
<th>Staff</th>
<th>Student population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Academic</td>
<td>Non-Academic</td>
</tr>
</tbody>
</table>
| F1. Faculty of Arts and Social Sciences (FASS) | Economics  
Geography  
History  
Foreign Languages and Linguistics  
Literature  
Political Sciences and Public Administration  
Sociology  
Statistics  
Kiswahili  
Fine Performing Arts  
Economic Research Bureau (*) | 148 | 70 | 1836 |
| F2. Faculty of Commerce and Management (FCM) | Accounting  
Finance  
Marketing  
General Management  
Human Resources Management | 39 | 14 | 740 |
| F3. Faculty of Education (FoED) | Educational Foundation  
Educational Planning and Administration  
Curriculum and Teaching  
Educational and Psychology  
Physical Education  
Sports  
Culture  
Bureau of Educational Research and Evaluation -BERE (*) | 45 | 23 | 280 |
| F4. Faculty of Engineering (FoE) | Chemical and Process Engineering  
Civil Engineering  
Electrical Engineering  
Mechanical Engineering | 97 | 170 | 1141 |
| F5. Faculty of Law (FoLaw) | Law | 28 | 18 | 605 |

Table 6.1.1 – Academic and non-academic staff and student population by units and courses offered by UDSM
## Table 6.1.1 (cont.) – Academic and non-academic staff and student population by units and courses offered by UDSM

<table>
<thead>
<tr>
<th>Faculties (F1 - F6), Institutes and other units</th>
<th>Courses</th>
<th>Staff Academic</th>
<th>Non-Academic</th>
<th>Student population</th>
</tr>
</thead>
<tbody>
<tr>
<td>F6. Faculty of Science (FoSc)</td>
<td>• Botany • Chemistry • Computer Science • Geology • Mathematics • Physics • Zoology and Marine Biology</td>
<td>127</td>
<td>137</td>
<td>1001</td>
</tr>
<tr>
<td>Muhimbili University College of Health Sciences (MUCHS)</td>
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<tr>
<td>Faculties:</td>
<td>• Dentistry • Medicine • Nursing • Pharmacy</td>
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<tr>
<td>Institutes:</td>
<td>• Allied Health Sciences • Development Studies • Public Health • Primary Health Care • Continuing Health Education • Traditional Medicine</td>
<td>175</td>
<td>107</td>
<td>789</td>
</tr>
<tr>
<td>University College of Lands and Architectural Studies (UCLAS)</td>
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</tr>
<tr>
<td>Faculties:</td>
<td>• Architecture and Planning • Lands and Environment Engineering</td>
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<tr>
<td>Institutes:</td>
<td>• Institute of Human Settlement Studies (IHSS)</td>
<td>99</td>
<td>105</td>
<td>689</td>
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<tr>
<td>Centres:</td>
<td>• Centre for Continuing Education • Geo-Information Centre</td>
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<tr>
<td>University Computer Centre (CC)</td>
<td>• Teaching short courses Computer-related Courses and professional courses • Research and Informatics • Provision of ICT services and Consultancy to UDSM and Community</td>
<td>0</td>
<td>56</td>
<td>0</td>
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<td>University Library (UL)</td>
<td>• Technical Services • Reader Services • Research and Documentation</td>
<td>26</td>
<td>74</td>
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<tr>
<td>Institute of Development Studies (IDS)</td>
<td>• Theoretical and Practical Prospective of Development • Tanzania's Development Experiences and Comparative Analyses of Development Processes</td>
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<td>16</td>
<td>8</td>
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<td>Institute of Resource Assessment (IRA)</td>
<td>• Natural Resources and Environment • Population and Human Settlement • Agricultural Systems</td>
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<td>Institute of Kilembe Research (IKR)</td>
<td>• Linguistics Section • Lexicography Section • Terminology and Translation Section • Literature Section • Administration Section</td>
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<td>16</td>
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<tr>
<td>Institute of Marine Sciences (IMS)</td>
<td>• Research and Advanced Training in all Aspects of Marine Sciences • Advisory and Consultancy Services</td>
<td>17</td>
<td>52</td>
<td>-</td>
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<td>Institute of Production Innovation (IPI)</td>
<td>• Product Innovation up to marketable product and subsequent transfer to a suitable industry • Consultancy and Services to Industry • Supply Curriculum Advise to the Faculty of Engineering through its Feedback from industry</td>
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<td>Administrative Units (Registry, Bursary, Maintenance and other units)</td>
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<td>0</td>
<td>357</td>
<td>0</td>
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<tr>
<td>Total</td>
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<td>872</td>
<td>1286</td>
<td>7089</td>
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Chapter 6 – Assessing the University of Dar Es Salaam (UDSM) - Tanzania

Services
The university provides a number of services to support its main mission of education and research. Such services include:

- **Transport** - The university provides some transport services for staff and students.
- **Library** - The university provides on-line services in its central library to students and academic staff. The university (central) library provides support to students and academic staff in the form of books, journals and ICT facilities for accessing relevant information.
- **Security** - The university has security services to safeguard and protect its assets.
- **Social Services** - The university provides to the students and staff social services such as health care services, career and counselling services, legal services, and scholarships.
- **Housing** - The university provides student accommodation facilities and runs housing facilities for academic and administrative staff.
- **ICT** - The university has a Computer Centre, which has the status of a limited company and provides ICT services to the university, and externally at a commercial price.

Administration supporting education, research, and services
The organizational chart of UDSM’s administrative and managerial structure - the Officers of the University (Vice-Chancellor and two Deputy Vice-Chancellors), University Council and Senate - is presented in Figure 6.1.2.

![Organization Chart](image)

---

**UTLIP** University Teaching, Learning Improving Programme
**DPGS** Director Post Graduate Studies
**PMMO** Principal Manpower Management Officer
**DUP** Dar Es Salaam University Press
**IGU** Income Generation Unit
**UCC LTD** University Computer Centre LTD

Figure 6.1.2 – Organization chart of the UDSM administrative structure, 2001
The Vice-Chancellor is the main authority within the university and is responsible for the administration of the whole university. The administration of the university takes place in two separate sub-structures, each headed by a Deputy Vice-Chancellor as shown in Figure 6.1.2.

One of the Deputy Vice-Chancellors, the Chief Academic Officer, deals with the coordination of the education and research activities of the university. The structure of this administration operates at central level and at faculty level. The Director of Post-Graduate Studies and the Director of UTLIP (the University Teaching and Learning Improvement Programme) centralize the administration of the university’s scientific and pedagogical issues and provide support to faculties in scientific matters. Through their departments, the deans of the faculties assure a proper implementation of the education and research programmes/activities in the respective academic units. The management of the academic staff is centralized under the responsibility of the Principal Manpower Management Officer, who in cooperation with the academic departments assures a proper allocation and utilization of the academic staff.

The second Deputy Vice Chancellor, the Chief Administrative Officer, co-ordinates the second administrative sub-structure, which deals with Student Affairs, Health Centre, and Admissions. The following directorates also fall under his responsibility: the Bursary, Personnel, Finances, Estates, Cafeteria/Canteen, Income Generation Unit, Halls of Residence, Convocation and the UDSM Auxiliary Police. The Computer Centre Ltd of UDSM and the Dar Es Salaam University Press Ltd, also in this sub-structure, have been created not only to provide support to the university in their respective areas but also to provide their services to outside clients on a commercial basis.

The Estates Directorate is responsible for administrating the university patrimony, its acquisition, distribution/allocation and safeguarding of the university assets, and also directly undertakes supporting services in this field. This Directorate shares with Finance Directorate the administration of acquisition of goods and their regular inventory. The acquisition of hardware and software are formalized, but in general, acquisition procedures do not fully comply with the recommendations established within the university since the faculties, institutes, colleges and centres of the UDSM can mobilize their own financial resources and can acquire goods directly from suppliers with little coordination with the CC.

The Finance Directorate centralizes the administration of finances, mainly from the state budget and from centrally coordinated financial donations to the university. In this way the Finance Directorate provides support to the whole university in financial administration matters.

The Personnel Directorate centralizes the administration of university staff and provides support in human resources administrative issues. Together with the Finance Directorate this directorate is responsible for the university payroll. The management of all university staff is carried out in both the academic and the administrative sub-structures through the PMMO, which deals with academic staff, and the Personnel Directorate, which deals with non-academic staff. Although this arrangement aims to clearly demarcate the management of academic and administrative staff, it requires more coordination between the two sub-structures. At unit level, each academic or administrative unit is responsible for the management of its staff by applying the general rules and procedures coordinated at central level.

The Press and Bookshop provides services to the university in this area. The acquisition of books follows formally agreed procedures.

In order to reinforce the administration, the university has initiated a number of reforms (Figure 6.1.3). The major reforms are computerization of administrative and academic functions, decentralization of financial and academic decisions, computerization of library services, curricular review, semesterization, computerization of the human resources management system, and the establishment of a new organizational structure.
Chapter 6 – Assessing the University of Dar Es Salaam (UDSM) - Tanzania

Strategic Objectives
1. Improving the legal framework, organization and management
2. Enhancing the speed and impact of institutional transformation programme
3. Expanding UG and PG student enrolment
4. Improving quality and relevance of teaching and learning
5. Improving capacity and development of human resources
6. Increasing volume and improving quality of research and publications
7. Improving marketing and public relations
8. Improving library and publishing services
9. Increasing the volume of and improving the quality of consultancy and services to the public
10. Improving student affairs
11. Increasing the number and productivity of national and international linkages
12. Improving the Information and Communication Technology capacity and its effective use
13. Improving the gender balance and mainstreaming
14. Improving health services
15. Improving infrastructure and estates management
16. Enhancing capacity for financial management and sustainability

Strategic Objectives
- Coordinating ICT developments
- Increasing ICT capacity
- Using ICT in core mission of the university activities
- Enhancing ICT applications in Library Services
- Strengthening the UDSM-AVU Project (Distance Learning)

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<tr>
<th></th>
<th>Univ.</th>
<th>Gov.</th>
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<tbody>
<tr>
<td>Master Plan II of INFOPOL</td>
<td>✓</td>
<td>-</td>
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<tr>
<td>Flexible Act Approval</td>
<td>✓</td>
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<tr>
<td>New Organizational Structure</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Colleges, Faculties, Institutes Clustering</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Computerization of Administrative and Academic Functions</td>
<td>✓</td>
<td>-</td>
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<tr>
<td>Decentralization of Financial Academic Decisions</td>
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<td>Rationalization of Support Services</td>
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<tr>
<td>Enrolment of Privately Sponsored Students</td>
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<tr>
<td>Development of Research Agenda</td>
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<td>✓</td>
</tr>
<tr>
<td>Computerization of Library Services</td>
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</tr>
<tr>
<td>Establishing and Strengthening Continuing Education</td>
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<tr>
<td>Developing and Implementing Student Affairs Policy</td>
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<td>✓</td>
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<td>Developing and Maintaining Units</td>
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<tr>
<td>Semsterization</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
</tr>
<tr>
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</tr>
<tr>
<td>Gender Equity</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>HIV Interventions</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Computerization of Human Resources Management System</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Figure 6.1.3 - Ongoing processes at UDSM
In these reforms, two categories can be identified. The first one is related to reforms which are a continuation of previous activities initiated in INFOPOL I (see below), such as computerization of library services, and computerization of human resources management. In the second category we find new structural and organizational reforms, such as curricular review, decentralization of financial and academic decisions, and the establishment of a new organizational structure. The organizational and structural reforms aim to establish an organizational structure, processes and procedures that are responsive to the demands of the new curricula. These reforms have raised considerable discussion on the issue of decentralization and reallocation of functions and responsibilities at different levels in the university. Decentralization is needed both in the academic and administrative areas of the university. This reform therefore concentrates on creating a new organizational structure including aggregation of units, transfer of functions from one level to others, rationalization of both academic and non-academic personnel in a Human Resources Plan, and finance allocation and management.

In relation to ICT, in 1995 UDSM approved its Information Policy Plan (IPP), which was followed by an Information Technology (IT) master plan in the same year. The IPP became the main guidance for ICT development within the university and provided direction for the relation between the university, the government and other players in the ICT field, including donor agencies. The policy established guidelines for ICT standards, with an emphasis on openness to emerging trends (open systems/multi-vendor management architecture). A distinction was also clearly spelt out between central ICT tasks and decentralized ICT tasks. The IPP was closely related to the IT master plan, which described the major activities for the implementation of the computerized administrative information systems, the installation of the required computer capacity and communication facilities, and the required organizational arrangements and training.

In the ICT Policy Plan (IPP) and IT master plan a common university-wide vision on the role of information, ICT and ICT management organization is described together with a course of action towards achieving this vision. This course of action, set out in the IT master plan, comprised the phased implementation of the various information systems, the implementation of a university-wide network infrastructure linked to international networks, the establishment of a building for the Computer Centre and a comprehensive staff training programme.

The ICT projects identified within the master plan are:
- Financial Information System (FIS)
- Academic Registry Information System (ARIS)
- Human Resources Management Information system
- Library Information System (LIBIS)
- Contract/ Project Information system
- Management Information System
- Computer and Communication Network Infrastructure (INFRA)
- Systems Development Environment
- Computer Centre Building (CC-CON)
- Upgrade professional level of Computer Centre
- Upgrade expertise for functional and application management

Many of these projects were implemented through INFOPOL I (see below). The remaining projects are yet to be reviewed for implementation. Later, it was realised that the end-user training in making the most efficient use of the installed ICT facilities was an area of priority and it was included in the programme.

With the support of donors, the INFOPOL I project was established in 1995, to start implementation of the IPP. This project was designed to permit the realization of the major decisions made in the IPP and master plan and was fully financed by donors. The INFOPOL aimed to improve the institutional capacity of the UDSM in the areas of academic and administrative management, research and development by improving its data processing.
capacities and its information resources management, as defined in UDSM’s IT plan and IT master plan.

Under INFOPOL I, the following ICT projects included in the master plan were implemented:

- the financial information system (FIS), aiming to establish a computerized information system for UDSM’s financial administration;
- the academic registry information system (ARIS), aiming to establish a computerized information system for UDSM’s academic registry;
- the library information system (LIBIS), aiming to computerize the UDSM library;
- the data communication infrastructure, aiming to develop and implement a university-wide ICT infrastructure (INFRA);
- the construction of a new and appropriate building for the university computer centre (CC-CON);
- upgrading the professional level of the computer centre in order to develop the organizational arrangements necessary for the continuous operation and maintenance of UDSM’s information resources;
- the human resources management information system, aiming to establish a computerized human resources management information system.

Clearly the strategy behind this project was to focus mainly on the establishment of general Administrative Information Systems (e.g. for the library, human resources, and finance) and also paid considerable attention to the establishment of the IT unit and to the common communication infrastructure.

As a result of a review of INFOPOL after five years, INFOPOL II is now in progress, in which UDSM pays greater attention to the integration of ICT into the core activities of the university, which are research and education. For example, INFOPOL II covers priority areas for ICT such as on-line learning, end-user ICT training, E-learning, Blackboard, and distance education. It also covers new areas such as the organization of ICT services and responsibilities, the cost of ICT services and budgeting them. It introduces the principle of implementing ICT activities within the project/user group concept, in which user units are clustered into working groups. For instance, the Information Technology Students’ Association of the Dar Es Salaam University has been formed so that students can acquire knowledge of ICT, increase their expertise and prepare for a sound professional career after their studies. This may contribute to the levelling of knowledge among users. The risks associated with the implementation of the strategy, and ways to reduce these risks have been studied by the students’ association.

At the time of our research, the impact of INFOPOL II had not yet been felt. Nevertheless, we were able to verify that the implementation of INFOPOL I had positive results, such as the establishment of the Computer Centre and the data communication infrastructure. The successful establishment of the administrative systems has, however, been compromised by lack of skilled staff and lack of financial resources.

In INFOPOL II, new strategic issues are introduced, but UDSM still has not addressed the issues of decentralization versus centralization, cost of ICT services, ICT security, ICT service management. The fact that the CC has been established does not mean that it already provides ICT services at a professional level. Such an assessment has not been made in the INFOPOL II. Investments in ICT, however, are continuing, and the ICT infrastructure is being extended more and more.

People
Academic staff, non-academic staff and students of UDSM form the UDSM population. The university population can be expressed as follows:

**Numbers:** 872 academic staff, 1286 administrative and non-academic staff and 7089 students.
Education. All academic staff have a university degree. Most non-academic staff do not possess a university degree.

Experience. Nearly 100% of the academic staff are experienced in their field. Around 60% of the administrative staff are experienced in their field. In the academic staff area, difficulty is experienced with finding qualified and experienced staff to replace staff who retire.

Personnel Turnover: In university terms, the staff turnover is relatively stable. Most of the university staff are paid for extra activities and they rarely leave the university. In the ICT field, however, many have left the university after their training.

Situational Factors.

Specific situational factors. Culture of the UDSM and starting point of ICT.

Culture: When it comes to decision-making processes, people who are part of the various committees may first agree on something and think that this is the way to go. But when it comes to implications or the impact of this collective decision, the same people may refuse responsibility for the outcome.

Starting point of ICT: In 1970, ICT at UDSM started: a computing unit was established at the Department of Mathematics. The Department had an ICL 900 computer for programming and payroll, statistics, and teaching of students. In 1980 the decision was made to create a university Computer Centre (CC) to deal with ICT. No new staff were recruited for this new centre. Instead, staff were transferred from other departments. Towards the end of the 1980s, with the support of UNESCO, a computer science programme was started. International trends in ICT helped to start new courses in the 1990s, given by the staff of CC but leading to graduation from the Mathematics Department. When the PC boom started, towards the end of the 90s, the faculty became autonomous and lectures on computer science were given more and more by staff of the faculty rather than by the CC.

Generic situational factors. Relationship with ICT suppliers and discontinuity of management.

Relationship with ICT suppliers: The relationship is very basic and is limited to the guarantee period. The suppliers are described as traders who merely sell products as agents of international suppliers, without having the capability to establish an after-sale service themselves.

Discontinuity of management: Leaders in the academic units (faculties/departments) are rotated every three years and most of the leaders learn management on the job. In some cases this creates discontinuity of management because the people approving the plans may not necessarily be the people who are present when they are implemented. Renewal of a management position is possible, however.

Conclusions

Education and research at UDSM also covers education and research in the area of ICT. As part of the ongoing internal reforms, the university has revised its INFOPOL plan. The review process has demonstrated that most of the aspects covered by INFOPOL I are still valid. However, it was also decided to give greater emphasis to teaching, learning and research in the field of ICT, and to academic information systems and distance education, thus demonstrating the university's intention to have ICT support its core business. Like INFOPOL I, INFOPOL II covers some relevant strategic issues, although others are missing, including ICT security, ICT service costs and budgeting and the decentralization of ICT services and its management. Despite the existence of the ICT strategy, the university is not applying ICT in full in its daily activities.
6.2 Subjects and objects for assessment of the entity ICT using the MCM paradigm

In relation to the entity ICT, we formulate the following subjects and objects:

- Complexity factors
- Hardware/Software/Communication characteristics
- Data set characteristics
- Procedure characteristics

**Complexity factors**

**Quantity.** 1674 PCs, a number of communication facilities, 5 operating systems and 18 application software packages are available. ICT within UDSM is growing: the university has new information systems, and more computer labs and Internet connection points.

**Diversity.** UDSM has various types of ICT components from different manufacturers and origins, and this forces the university to have relationships with the ICT suppliers of all these types of ICT components.

**Distribution.** UDSM has its ICT dispersed over its different locations.

**Dynamics.** Changes in hardware and software take place slowly. CC staff, staff of faculties and of ICT suppliers introduce changes in the hardware and software. Such changes are not controlled but take place in an ad hoc manner.

**Functionality.** ICT is employed for different functions within UDSM.

**Relationships.** There is a university ICT network. However, the administrative systems are not all part of this network.

**Ownership.** The university owns the ICT. The Vice Chancellor has delegated some of his responsibilities to the heads of academic and administrative units, and this delegation of responsibilities also involves the allocation of ICT to them.

**Utilization.** In each academic or administrative unit the users utilize the ICT available. Academic staff and students access and utilize ICT differently from administrative staff. While academic staff and students use the available ICT freely for their specific individual needs, administrative staff apply ICT only for specific tasks. For example, the library staff can only use ICT in the Library Management Information System.

**Sophistication.** The university ICT is very advanced. The majority of the university staff has insufficient knowledge of the available ICT, which makes it difficult for them to understand it and to use and/or service it properly.

Figure 6.2.1 illustrates the complexity of ICT and the variety/diversity in communication facilities. Table 6.2.1 gives information about the capacity of these communication facilities.

<table>
<thead>
<tr>
<th>Type</th>
<th>Topology</th>
<th>Capacity</th>
<th>Beneficiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Backbone</td>
<td>Fibre Optic</td>
<td>100/Mbps</td>
<td>All departments/faculties at the main campus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1Gbps</td>
<td></td>
</tr>
<tr>
<td>Local Area Networks</td>
<td>UTP</td>
<td>10/100Mbps</td>
<td>All departments/faculties</td>
</tr>
<tr>
<td>Metropolitan Network</td>
<td>Wireless</td>
<td>11Mbps</td>
<td>The two off-campus colleges MUCHS and UCLAS and the Ministries/Government Institutions</td>
</tr>
<tr>
<td>Wireless Technology</td>
<td>(Wave LAN)</td>
<td>Star</td>
<td>The two off-campus colleges MUCHS and UCLAS and the Ministries/Government Institutions</td>
</tr>
<tr>
<td>Internet</td>
<td>Leased line &amp; Satellite</td>
<td>256/512 &amp; 512Kbps/1Mbps</td>
<td>UDSM &amp; Ministries/Government Institutions</td>
</tr>
</tbody>
</table>

Table 6.2.1 - Networking infrastructure capacity of UDSM
Figure 6.2.1 - University of Dar Es Salaam infrastructure, 2001
Chapter 6 – Assisting the University of Dar Es Salaam (UDSM) - Tanzania

Hardware/Software/Communication characteristics, such as:

Network capacity
The ICT supporting the university at the main campus consists of a number of Ethernet LANs (Ethernet 10/100Mbps) dispersed over the buildings of the main campus. The LAN of each building is connected with concentrated computing facilities by an 8.2 km fibre optic backbone network, running at 100 Mbps and linking 28 academic buildings/departments and the main administration. This creates a matched ring of 1 Gbps and star of 10/100 Mbps network.
The concentrated computing facilities are connected through Simunet Company. 512 Kbps are dedicated for the university. The university Computer Centre, as a separate company, uses 512Kbps from a different supplier (Simbanet). At the moment all departments in the main campus and the two off-campus colleges, UCLAS and MUCHS, use this link, while the Institute of Marine Science (IMS) situated at Zanzibar island uses a direct 64Kbps link to Simunet.
This Internet link is located at the university Computer Centre and provides access to the Internet, not only for the university but also for government departments, the private sector and NGOs on a commercial basis.
The link to the University College of Lands and Architectural Studies is through a 11Mbps wireless-based line. A similar connection is in place between the main campus and the Muhimbili University College of Health Sciences.

Standardization. The Interface is Internet Protocol (IP) but there is no ICT standardization policy.

Quality of technical facilities. The technical facilities are of good quality.

Data set characteristics, such as:

Extent. The existing databases are of small and medium size. They consist of the Finances Information System, Student Records Information System, Payroll and Personnel Information System and Library Information System.

Standardization. There is very little standardisation of database management systems.

Database management software. Oracle, SQL and Access database management software are applied within UDSM.

Procedures’ characteristics, such as:

Number. The total number of procedures is not known.

Extent. Procedures are based on practices. Few are in writing.

User friendliness. The existing written procedures are formalized. The available procedures on areas such as Backup procedures and Security are said to be user friendly.

Language. The existing procedures are mainly written in English, the official language. The technical documentation is also written in English.

Conclusions
UDSM has a very extensive ICT infrastructure and a huge number of components. The available ICT is of several types and from different manufacturers and origins. A good understanding of this highly complex ICT infrastructure is required. So are well-defined user groups. Professional ICT service management is also required to support the implementation and utilization of the ICT in accordance with requirements, preconditions and situational factors of the university so that the ICT can influence the university’s core business in a positive way. Relationships with suppliers are generally conducted on an ad-hoc basis.
6.3 Subjects and objects for assessment of the entity MCM using the MCM paradigm

In relation to the MCM entity, we focus on the following subjects and objects:
- Organization
- Tasks with reference to task areas and task fields
- Processes
- Procedures
- People

Organization
The Management, Control and Maintenance (MCM) of the ICT supporting the university is centralized in the University Computer Centre (CC). The Computer Centre Ltd, a limited liability company wholly owned by the University of Dar Es Salaam, started as a centre that was to conduct lectures in all computer-related courses, to conduct research in informatics and to provide computing services and consultancy on ICT to both the university and the public at large.

Some MCM activities are also undertaken by certain faculties, such as the Faculty of Engineering and Faculty of Science, and by external ICT services, such as the national Posts and Telecommunications Operator, the public electricity company, international suppliers of Internet and ICT services.

CC operates as an ICT service provider for the entire university. The major objective of the UDSM for CC, as stated in the INFOPOL plan, is that it supports UDSM as a whole in the process of ICT planning, deployment, training, management and maintenance. This objective derives from the UDSM five years rolling strategic plan 2000-2004, which states the need for UDSM to strengthen the culture of promoting and using Information Technology in the core UDSM business and to significantly enhance the IT capacity and use at UDSM.

To achieve these objectives, the Computer Centre is mandated to oversee all ICT activities in the university. In this regard, CC provides:
- advice and support to UDSM units during ICT planning and development stages;
- procurement and installation of ICT hardware and software;
- technical ICT implementation, maintenance and support services;
- user training;
- provision of similar services outside the university.

Since 1st July 1999, all academic matters have been transferred to the newly formed Computer Science Department under the Faculty of Science. As a result the Computer Centre can now concentrate on the development and management of ICT services for the university, the public in Tanzania, and elsewhere. In order to emphasize the business aspect of CC, the Council of the university passed a resolution in May 2000 transforming the centre into a limited liability company. The centre is now a fully fledged limited liability company. This latest development gives the centre the much-needed flexibility to operate both within and outside the university. The intention is to serve the university as a priority area and to sell the excess capacity outside. Within CC, activities are undertaken through specialized units and staff as indicated in Figure 6.3.1.
The University Computer Centre Ltd has 56 staff and is organized in to the following departments:

- **Software Engineering and Maintenance (SEM):** The department is involved in design, development, implementation and maintenance of different management information systems and multimedia solutions for the University of Dar Es Salaam as well as for other individuals, companies and organizations. Qualified and experienced systems analysts and programmers are working in this area. Services include systems analysis and design, systems implementation, systems maintenance, programming in various languages, database design and implementation, and web design and hosting.

- **Hardware Engineering and Maintenance (HEM):** This department is divided into three major sections, namely a hardware workshop, a wireless design and installation section and Local Area Network section. The workshop is responsible for maintenance and repair of the ICT equipment. The University Computer Centre offers the wireless/leased communication service to various companies, educational institutions, research centres, government institutions and non-government institutions. The centre also has diverse experience in the design, installation, configuration and maintenance of computer networks. On the home front, the centre has installed and manages the campus-wide area network (fibre optic WAN) of the university and a Metropolitan Area Network (wireless link MAN) connecting the main campus with UCLAS and MUCHS. Moreover, each faculty of the university now has its own Local Area Network (LAN).

- **Service Control Department (SCD):** this department deals with management and administration of the services provided by CC Ltd. to its various clients. It performs functions such as Configuration Management, Help Desk and SLAs.

- **Training Department (TD):** offers a variety of courses including regular short courses, executive programmes, tailor-made packages and professional courses. These courses centre largely on teaching the use of the most common business
applications to enable individuals and the business community to improve their performance through the use of computer capability and Information Communication Technology. CC Ltd is now a certified Cisco Regional Networking Academy for Tanzania and plans are on the way to have it certified as an Oracle training centre.

- Marketing Department (MD): its main function is to market the services offered by the centre.

The Director provides strategic direction and is not involved in operational or technical management, which is the responsibility of the Deputy Director, together with the Services Control Department and the heads of the technical support departments (SEM, HEM, SCD, TD, MD).

Tasks
According to the summary of the MCM paradigm and the Three Kinds of MCM/Expansion models presented in Chapter 4, management tasks can be found and performed within the MCM entity of the MCM paradigm and within the Three Kinds of MCM, forming Functional Management (FM), Application Management (AM), Technical Management (TM). In the MCM entity, such tasks are realized in more than one organization. Within UDSM, the CC, with a certain level of organization and some experience, performs most of the TM. AM and FM are weakly performed. Section 6.7 will discuss all tasks and organizations performing them in more detail by means of the model the Three Kinds of MCM.

Processes.

Incident Management. Incidents are logged into the existing Helpdesk. The Helpdesk is located at CC. On-line support services to solve logged incidents are offered by qualified CC staff. When the incident cannot be solved over the phone, technical staff of CC are sent to the client for in-depth investigation and restoration of services. In general most of the incidents reported are cleared. Solutions provided are not always kept recorded.

Problem Management. CC staff carry out some form of problem management. In general, problems are solved but without going to the root cause of the problem, and so problems often recur sometime after the repair. Thus problem management is not dealt with professionally.

Change Management. New ICT is acquired and as a consequence some form of change management takes place. CC, staff of faculties, and ICT suppliers perform some change management on an ad hoc basis. This is not formalized.

Configuration Management. Occasionally configuration management for hardware and software takes place. In general CC or faculties or administrative units undertake ICT acquisition independently. Sometimes, however, these units acquire ICT through CC. Sometimes donations are made directly to CC or to other units within the university. This makes it difficult to maintain a university-wide inventory.

Release Management. No release management takes place

SLA Management. Service Level Agreement Management is at a very low level. SLAs are not formalized in agreements with UDSM entities. This leaves room for accusations of lack of performance by the parties involved.

Capacity Management. The faculties and CC perform some capacity management on an ad hoc basis.

Contingency Management. No contingency management is done.

Availability Management. Some sort of availability management exists.

Cost Management. Some sort of cost management is done.

Management of Network Services. Network services are managed by CC.

Procedures in written form, verbal form
Most of the procedures for the realization of MCM tasks are communicated orally. A limited number of procedures performed by the CC and by external ICT service suppliers are in
written form in English, the official language. Support documentation consists mainly of the technical and user manuals/ documentation which is supplied together with hardware and software and is written in English.

People

**Number.** Around 40 people from CC, faculties, and external ICT suppliers realize MCM tasks in one way or another.

**Education.** Around 25% of the staff realizing MCM tasks have some understanding of them, most of them CC staff.

**Experience.** Around 10% of the staff dealing with MCM tasks have many years of working experience in their field of ICT operation. This number is insufficient to handle all the needed service management in a professional manner.

**Personnel Turnover.** University staff with MCM skills can easily get well-paid jobs outside the university. With the exception of ten of the most experienced CC staff, staff generally leave the university as soon as they have about two years' experience and have done a certain number of ICT courses.

Conclusions

The MCM at UDSM is centralized at CC, which thus plays an important role in the realization of MCM tasks. Some faculties and external ICT service suppliers also perform some MCM tasks. Not all MCM processes are covered either by the Computer Centre and other organizations involved. The processes that are carried out may not be done at an appropriate level. There is no formal accountability for services provided. SLAs are not formalized and few procedures are in written form. Most of them are communicated orally. Within the CC there are capabilities for defining SLAs, but the CC management does not demand their elaboration. UDSM still neglects a lot of MCM tasks which need to be performed professionally, systematically and appropriately in to support the university's key tasks.

6.4 Subjects and objects for assessment of internal relationships using the MCM paradigm

In relation to the internal relationship, we formulate the following subjects and objects for assessment:

**Relation RS —> ICT. Requirements and preconditions**
The university exploits for its own benefit the student records information system, the payroll and human resources information system, the finance information system, library information system, assets information system, ICT-based distance education, and the UDSM computer network. The lack of skilled user groups prevents the university from getting the best out of its ICT for realizing its core business.

**Relation RS ——> ICT. Way of support**
The university is supported in its activities in relation to students, staff, finances and education and research by the student records information system, the payroll and human resources information system, the finance information system, the library information system, the assets information system, ICT-based distance education, the UDSM computer network. It is not always possible to extract the information generated by the ICT when needed because of the limited number of qualified users.

**Relation ICT —> MCM. Kind of data to support MCM**
The technical staff of CC and suppliers are supported by the UDSM computer network as it supplies them with data through the student records information system, the payroll and human resources information system, the finance information system, the library information system, the assets information system, ICT-based distance education. The advanced ICT and lack of skills on the part of staff do not always allow proper interpretation of the data generated by ICT.
Chapter 6 – Assessing the University of Dar Es Salaam (UDSM) - Tanzania

Relation ICT ← MCM. Way of management
Technical staff at CC and staff of suppliers, in collaboration with the user departments, manage the student records information system, the payroll and personnel information system, the finance information system, the library information system, ICT-based distance education and the UDSM computer network. Because AM and TM tasks are not carried out and the available data are sometimes interpreted wrongly, in many cases situations are created where decisions are not supported by the data provided.

Relation RS → MCM. Requirements and preconditions
The university employs CC technical staff to manage the Student Records Information System, the Payroll and Personnel Information System, the Finance Information System, Library Information System, Distance Education System and UDSM computer network. In this relationship the university has not established detailed SLAs in which the requirements and preconditions to be fulfilled by the CC are stated.

Relation RS ← MCM. Way of support
Technical staff members of CC respond to user requests within the university. There are no formalized SLAs governing such requests. CC staff respond to the requests as part of their duties as employees of the university.

Conclusions
The university has formulated requirements and preconditions for the existing ICT. Areas covered by ICT support are clearly defined. Users cannot fully exploit the ICT available because there is a deficit in ICT knowledge in the user groups. MCM tasks are not realized at an appropriate level nor with appropriate coverage. From the sophisticated ICT available many data that could be used for prompt decisions are generated, but the lack of understanding and skills for interpreting them do not always allow their use, thus creating weaknesses in the ICT service management. UDSM has not established formalized service level agreements with bodies employed by the university to perform MCM tasks. Requests made for ICT services are handled on an ad-hoc basis.

6.5 Subjects and objects for assessment of the external influences using the MCM paradigm

Economy
Tanzania is one of the poorest countries in the world [ACR2000]. The budget allocation for education is decreasing gradually and the university is tending to depend more on donor funds. Bureaucratic procedures impose high costs, resulting in a less attractive environment for investors in general and in particular in the area of ICT.

The consequence of very limited internal resources for ICT is frustration within the small, skilled ICT community at the slowness with which ideas can be implemented; it also means that those experts spend an inordinate amount of time on fund-raising to ensure that some ICT development can take place. They are also subject to pressure from donors who do not necessarily share the national priorities – often programmes identified as important by national institutions must be reshaped to fit donor agendas.

Education
As one of the first countries in Africa to gain independence and one of the first that has had a policy of massification and diversification of education, Tanzania has made substantial progress in widening access to the education system. As part of a worldwide trend in terms of concentration of education in Africa, many of the citizens of Tanzania who graduated have a degree in the humanities or social science. Education in the areas of engineering and the exact sciences to which ICT belongs has not produced as many technical and scientific graduates as the country needs. This situation has been worsened because at a certain stage of the development of Tanzania, most qualified people left the country for better employment.
opportunities in the region or further afield, or to represent the government in missions outside the country.

Tanzania has consolidated its educational system, which now relies on local academic staff for most of the courses offered in the country. The ICT education in the country still depends on a small number of qualified academic staff to design and implement curricula with enough coverage of ICT issues. ICT courses are in great demand, but the number of people who graduate is very limited compared to the need.

Human resources to implement, use and support ICT within the university are extremely limited. There are very few people within the country with the technical and management skills needed for successful ICT implementation. UDSM strives to keep the qualified staff that it has trained. However, the market outside the university pays more and thus attracts many qualified staff. The statistics show that more than 8 staff members left the CC in the last 2 years. The limited human resource base makes it difficult to keep staff at UDSM. It also makes it difficult for the university to contemplate playing a full part in the global knowledge society, which is the frame within which much discussion with donors takes place.

**Governance**

In the public sector, to which the university belongs, the process of developing a national ICT policy and strategy has just started. The university is playing an important role in the development of the National Information Policy as a member of the ICT Government Task Force and as a provider of technical solutions and technical advice. The relationship between UDSM and the government is illustrated in Figure 6.5.1

Relation 1 indicates the relation between the university and the Head of State (President assisted by the Vice-President). The President nominates the Chancellor and Vice-Chancellor. Relation 2 is the relation between the university and the Vice-President (VP). Relation 3 is its relation with the Ministry of Finance (MF). The university presents its annual plan and budget to the MF through the Ministry of Science, Technology and Higher Education (MSTHE). The university reports on its activities and financial expenditures to the MF through MSTHE on a monthly basis. Relation 4 is the university's relationship with the Ministry of Labour, Youth Development and Sports (MLYDS). The university staff is part of the civil service and governed by public sector principles. In this relation we have the Administrative Tribunal for the formalization of staff contracts. Relation 5 is its relationship with the Ministry of Science, Technology and Higher Education (MSTHE). This ministry, among others, has to define policies and harmonise the sector of Higher Education in Tanzania. External rules tend to serve as frameworks and in general they do not take into account the specifics of the organization.

The university’s close relationship with government means that decisions are not always within the purview of university governance; they have a political dimension and can also be delayed by bureaucratic processes.

In a multiple relation such as this, the absence of a clear set of policies, defined procedures and identified processes can produce ad-hoc decisions that influence development of ICT within the university.

![Figure 6.5.1 - External influences on university governance, UDSM](image-url)
Donors
The main donors working with UDSD in the ICT field are: Nuffic (Netherlands); NORAD (Norway); SAREC/ SIDA (Sweden); VLIR (Belgium); the World Bank; UNESCO; the Ford Foundation and the Carnegie Foundation (the USA). These donors finance most of the ICT projects and in some cases they provide ICT as donations. The effort of the donors serves to complement the financial resources provided by the government. However, procedures for ICT acquisition are not the same for all donors. For each country (or donor organization), the financial management and reporting systems regarding ICT deployment are different, and differences can be also be found in the procedures for the acquisition of goods. As a consequence, management of ICT acquired through donors is complex and the sustainability of projects cannot be guaranteed.

Lack of a national information policy can be considered as one of the factors that have a less positive influence on donors at the national level. The small number of skilled ICT managers have to deal with many requests for the development of projects. The promotional activities of donors can draw resources away from national ICT objectives and disperse the small concentration of skills.

ICT Suppliers
The major brand names of European, American and Asian hardware, software and communication technologies can be found at UDSD. The ICT industry in Tanzania is still in its infancy and neither software nor hardware is produced in Tanzania. Dealers are supplied mainly by European or Asian companies. These, in turn, source ICT from other markets. Very few of the dealers offer after-sales service, and when they do, their services are regarded as very expensive. There is very little culture of selling ICT products with maintenance contracts.

There are more than eight (8) data communication companies, with Simunet covering the larger part of the country. Simunet is a subsidiary company of the Tanzania Telecommunications Company Ltd (TTCL), and has just been privatised. Simunet has established digital state-of-the-art technology, mainly between the regional capitals and the districts, using microwave connections. Fibre optic networks are only found in two cities, namely Dar Es Salaam and Arusha. Cell phone services are available in some regions. There are four cellular telephone companies including CeITEL, which is another subsidiary company of the TTCL.

Conclusions
UDSM is governed by civil service rules and is influenced on daily basis by the government. UDSDM decisions are not always within the purview of university governance. The low level of the economy of Tanzania and its dependence on external financing greatly influences the functioning of the university and negatively affects the implementation of strategies of institutions.

Although donors contribute greatly to finance ICT programmes, in many cases they pressure national institutions to reshape programs considered important nationally to fit donor agendas. ICT acquisition, for example, is generally very much influenced by the interests of the donor countries or organizations. This has a negative impact on the implementation of most ICT projects because important factors such as sustainability and skills building are not taken into account. Some donors organize regular ICT promotional activities in different and distant parts of the world, resulting in little positive impact on national activities. The promotional activities of donors often draw resources away from national ICT objectives and disperse the concentration of skills. This not only leads to delays in ICT implementations but also gives the few skilled staff less time to provide professional ICT services to the university.

As mentioned before, major brand names of European, American and Asian hardware, software and communication technologies can be found in Tanzania. Although the ICT components are still in the hands of a few Tanzanians, they are already highly diverse and
distributed throughout the country, making it necessary for Tanzanians to invest in the establishment of professional ICT service management.

The Tanzanian government has recently established a national ICT task force to design a ICT strategy that is expected to cater for the development of a national ICT industry and for the development of education and research in the ICT field.

6.6 Subjects and objects for assessment using the State Model/ Extended State Model

State Model/ Extended State Model: subjects and objects
- University Network. (State(s) and tasks and processes)
- Local Area Networks. (State(s) and tasks and processes)
- General Information Systems

University Network
After a long and intensive process of planning (the Planning State) in INFOPOL I, the States of Acquisition/Development and Implementation of UDSM Network were reached. As it is in use, the UDSM Network is now subject to various modifications, mainly to increase bandwidth, to introduce high-performance hardware and software, to establish more Internet access points throughout the university campuses, and to introduce ICT for distance education.

In the Extended State Model, the UDSM network can be said to be in the Utilization State, and that of Maintenance/Modifications. UDSM also has reached the stage where the initial 10 Mbits main backbone of the UDSM network can no longer handle the traffic generated within the university. A new 100 Mbits infrastructure is being put in place. In fact in some parts of the university the new infrastructure is operational, so now the university has two infrastructures for the same objective with the difference that one of the infrastructures has been exploited to its maximal capacity. In this regard, we also can say that the UDSM network as a whole, while suffering from modifications as result of use, has also reached the exploitation state. Utilization is affected by low international bandwidth for the Internet.

Local Area Networks
The Local Area Networks have passed the planning stage in all university buildings. In the majority of buildings (around 90%), LANs have been acquired/developed and implemented. In these buildings the LANs are in the U, M1/M2 and E states. Maintenance is carried out more often than modifications. The remaining 10% of the buildings are still waiting for funding for LANs to enter the Development/Acquisition State.

General Information Systems
Due to lack of internal capacity early on, in-house development of administrative systems was not possible and therefore the first information systems (the payroll system, SCALA and LIBIS for the library) could only be purchased from external suppliers.

Human Resources Management and Payroll Information System
The Human Resources Management and Payroll Information System has two sub-systems: the payroll sub-system, which is in the States U, M1/M2, and the human resources sub-system, which is in the Development State. The implementation of this information system was not smooth to start with, as its users were resistant to learn the system. On the other hand the system itself suffered from a lot of problems (bugs) as well and the suppliers of the system were merely vendors and had insufficient knowledge of the system.

In the Utilization State, the Finance Directorate runs the payroll subsystem and the Human Resources Directorate runs the human resources management subsystem in which activities such as data on new staff and staff absence are entered. This data is
then used by the payroll subsystem. This information system has never been used to its full functionality, because of the lack of skills on the part of both the users and the suppliers.

In the M1/M2 state, CC staff and ICT service suppliers are asked by the directorate of Human Resources to introduce new functionalities. The changing of functionalities has not been frequent and is made to satisfy requests by the top management of the university for different formats of information. Modifications and Maintenance are usually carried out by suppliers, in coordination with the CC.

In the Extended State Model all states are clearly defined and they are to be undertaken separately. What is happening with the Payroll and Human Resources Information System is in conflict with the Extended State Model because the two states are being carried out at the same time. The combination of the two states creates an opportunity for conflicts between the users and the developers and creates lack of confidence on the user side.

**Academic Registration Information System**

The academic registration information system is owned by the Academic Register Directorate and used by faculties and their departments, institutes and students. A consortium of universities, including UDSM, developed the UDSM academic registration information system.

The Student Information System is in the States U, M1/M2. In the Utilization State, the Academic Register Directorate runs activities such as data entry of new students, academic performance and new courses. The directorate then makes use of that data to produce information for various entities such as the top management of the university, the faculties, students, and government bodies. In the M1/M2 State, from time to time the Academic Register Directorate asks CC staff, ICT service suppliers and ICT service consultants to introduce new functionalities. Such requests are not frequent. In the Extended State Model all states are clearly defined and they are to be undertaken separately. Although modifications are not frequent, the combination of the two states creates an opportunity for conflicts between the users and the developers and creates a lack of confidence in users.

**Finance Information System**

The finance information system is located in the Finance Department (bursar’s office). The estimated number of end users of the system is around 30-40 in the central administration and 20 at unit level (faculties and institutes). The implementation of this information system was not smooth in an early stage, because its users were resistant to learn how to use the system, and the system itself had a lot of problems (bugs). Moreover, the suppliers of the system had insufficient knowledge of the system. It took more than a year before the system was up and running in the bursar’s office.

The finance information system is in the U, M1/M2 States. In the Utilization State, the Finance Department carries out activities such as accounting and entering and controlling budget data. This data is then used by the Finance Department to produce financial information for the top management of the university, for academic and administrative units of the university, and for government bodies and donors. The full potential of this information system has never been used. The reason for this under-utilization is lack of skills on the side of the users and the suppliers. In the M1/M2 State, the Finance Department has asked the CC staff, ICT service suppliers and ICT service consultants to introduce new functionalities. This has been done frequently to accommodate the ongoing financial reform within the university and to accommodate requests from donors. Modifications and maintenance are usually carried out by suppliers, in coordination with the CC.
In the Extended State Model all states are clearly defined and they are to be undertaken separately. What is happening with the Finance Information System is in conflict with the Extended State Model because the two states are being carried out at the same time. The combination of the two states creates an opportunity for conflicts between users and developers and creates a lack of confidence on the part of users.

Library Information System
The library information system is owned by the central library and has around 25 end-user stations at the library. The library information system is accessible throughout the university network and over the Internet. This system is in the Utilization State.

Conclusions
The UDSM Net, which constitutes a centrally planned, developed/acquired, implemented and managed ICT infrastructure, is now in the Utilization and Exploitation States. In parallel to the use of the existing main backbone, a new one is being established. Modifications in the existing ICT are being made to accommodate new technologies, to improve existing ones, and to provide more Internet access points. The majority of planned LANs in different buildings of UDSM have been realized and they are in use.

In relation to the implemented general information system, procedures are not in line with the Extended State Model. Utilization takes place while new functionalities are being introduced. The combination of the two states creates an opportunity for conflicts between the users and the developers and creates a lack of confidence on the part of users. Most of the planned general information systems have not been acquired/developed because of lack of financial and human resources.

6.7 Subjects and objects for assessment using the Three Kinds of MCM Model and the Expansion of the Three Kinds of MCM Model

6.7.1 Functional Management (FM)

Organization
Functional Management tasks at UDSM are undertaken mainly by the CC, and also by some faculties and administrative units. The university’s top management is also involved in some FM. The decentralization processes implemented within the university includes the decentralization of ICT, and therefore university units owning ICT carry out Functional Management. Users perform Functional Management with the assistance of staff of the CC and suppliers. However, not all tasks related to FM are implemented.

Tasks
Table 6.7.1 provides an overview of tasks undertaken by the different parties involved in FM tasks. The mark (V) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.
<table>
<thead>
<tr>
<th>Task Areas/Task Fields</th>
<th>University Computer Centre (CC)</th>
<th>Faculties and Administrative Units</th>
<th>External ICT Service Suppliers</th>
<th>ICT Consultants</th>
<th>University Top Management</th>
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<td><strong>Strategic Management (SM)</strong></td>
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<td>- Acquisition of ICT Resources</td>
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<td>- Functional Maintenance of Information Systems</td>
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<td>- Data Definition Control</td>
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Table 6.7.1 - Functional Management tasks undertaken by the different parties at UDSM

**Processes**
Processes related to FM are mainly undertaken by CC. Such processes were presented in Section 6.3, where the entity MCM was presented.

**Procedures**
Procedures for the realization of tasks are occasionally formulated and written down. Some of the procedures are implemented on an ad-hoc basis and they are not rigorously followed and controlled.

**People**
**Number:** 130 people are involved in FM
**Education:** 40% of staff have a university degree and have followed some sort of management course. 20 people dealing with FM have actually followed ICT courses.
**Experience:** Most of the staff involved in FM have more than five years of working experience in this area.
**Personnel turnover:** In general, personnel involved stay at UDSM, but often also have well-paid part-time jobs outside the university.
6.7.2 Application Management (AM)

Organization
The units involved in AM tasks are: the CC, faculties and administrative units, and ICT suppliers. The ICT suppliers are also involved in AM. Application management is performed mainly by users, but also by the staff of software application suppliers.

Tasks
Table 6.7.2 provides an overview of tasks undertaken by the different parties involved in AM tasks. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

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<thead>
<tr>
<th>Task Areas/Task Fields</th>
<th>University Computer Centre (CC)</th>
<th>Faculties and Administrative Units</th>
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Table 6.7.2 - Application Management tasks undertaken by the different parties at UDSM

Processes
Processes related to AM are mainly undertaken by the CC. Such processes were been presented in Section 6.3, where the MCM entity was presented.

Procedures
Procedures for the realization of AM are normally not in writing. If they are, they are not rigidly followed.

People
Number: Around 300 people are involved in AM
Education: 20% of staff involved in AM have a university degree. 80% of staff involved in AM have followed some sort of ICT course.
Experience: Most of the staff involved in AM have more than five years of working experience in this area.
Personnel turnover: University staff involved in AM can easily get better-paid jobs outside the university and usually they leave as soon as an opportunity presents itself.

6.7.3 Technical Management (TM)

Organization
Technical Management is performed in more than one unit within the university. External ICT suppliers also perform TM. The following units are involved in TM: the CC, the university computer labs belonging to faculties and some faculties themselves such as Engineering and Sciences. In the faculties, basic TM tasks are realized but complex TM tasks are performed by the CC, where TM tasks are concentrated. Hardware, software and communications suppliers are also involved in TM for UDSM.

Tasks
Table 6.7.3 provides an overview of tasks undertaken by the different parties involved in common TM tasks. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

Processes
Processes related to TM are mainly undertaken by the CC. Such processes were presented in Section 6.3, where the MCM entity was presented.

Procedures
Procedures for the realization of the TM tasks are not formalized nor rigorously applied/realized.

People
Number: The university has 100 staff members who are involved in the realization of TM tasks.
Education: 25% of these staff have a university degree. 6% have followed advanced ICT courses.
Experience: 20 university staff have more than 5 years of working experience in TM.
Personnel turnover: Staff involved in TM is very volatile: staff turnover is very high.
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<tr>
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<th>University Computer Centre (CC)</th>
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<td>• Data Processing</td>
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<td>• Advice and Participation</td>
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<td>• Information Supply</td>
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Table 6.7.3 - Technical Management tasks undertaken by the different parties at UDSM

Conclusions
Although they are generally not recognized as such, the Three Kinds of MCM are realized in one way or another within the university. Processes and tasks to be performed under the three kinds of MCM are vaguely known within the CC but are not strictly adhered to because they are not fully understood. In all three kinds of MCM, the CC plays a major role. The realization of tasks and processes is not formalized. They are performed on an ad-hoc basis. For the amount of ICT available there is a shortage in skills within the university in staff
Chapter 6 – Assessing the University of Dar Es Salaam (UDSM) - Tanzania

involved in the Three Kinds of MCM. The few available skilled staff have acquired knowledge through short ICT courses. However, qualified staff usually leave the university for better-paid jobs.

The education system in Tanzania does not offer ICT management courses in which skills in different types of management can be developed.

6.8 Drawing conclusions for the Big ICT Five

For the overall assessment of UDSM we formulate the following conclusions in relation to its ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization, ICT service management:

Concerning ICT - Strategy
The University of Dar-Es Salaam approved an ICT strategic plan for five years in 1995. In that plan, five main development areas were distinguished, mainly oriented towards the establishment of administrative support information systems, the establishment of the university ICT network, connecting to strategic partners and the establishment of a professional computer centre. Issues such as budgeting and costing of internal services, service level agreements, and role of ICT in education and research were missing. The university Computer Centre (now a limited liability company) was mandated to oversee the implementation of the plan. Given that financial resources for ICT mainly come from donors, there has been little co-ordination of ICT deployment in UDSM. The implementation of the first ICT plan, INFOPOL I, yielded positive results such as the establishment of the Computer Centre, and a data communication infrastructure. The positive contribution of the establishment of the administrative systems has been offset by lack of skilled staff and lack of financial resources.

As a result of the review of INFOPOL I after its five-year execution period, INFOPOL II has now been started, in which UDSM pays more attention to the integration of ICT into research and education, the core business of the university. For example, INFOPOL II covers priority areas for ICT, such as on-line learning, end-user ICT training, E-learning, Blackboard and distance education. It also covers new areas such as organization of ICT services and responsibilities for these, and the cost of and budgeting of ICT services. It introduces the concept of implementing ICT activities within a project/user group. In this concept, user units are clustered into working groups such as the Information Technology Students' Association of UDSM. This may contribute to the levelling of knowledge among users. Risks to the implementation of the strategy and strategies to reduce risks have been outlined.

Although, at the time of our research, the impact of the new ICT strategy had not yet been felt, we were able to make the following observations: in INFOPOL II, new strategic issues are covered, but the UDSM still lacks policies related to decentralization versus centralization, cost of ICT services, ICT security and ICT service management; moreover, the established Computer Centre cannot yet provide ICT services at a professional level. On the other hand, investments in ICT continue and the ICT infrastructure is being extended.

Concerning ICT – Development/Acquisition
The acquisition of ICT for general administrative information systems and the acquisition of a common ICT infrastructure is centralized at UDSM. For this, the university has an ICT steering committee, which together with the university Computer Centre has to check and approve ICT equipment/systems specifications before the final decision on its acquisition is taken by the university's top management. Acquisition of ICT equipment/software for faculties/departments and research groups is decentralized. They specify and acquire their ICT following general UDSM purchase procedures. Decisions on whether the university should develop its own information systems or acquire them from suppliers (in-house development versus acquisition from outside) are made on an ad-hoc basis and depend on the source of financing and availability of skills within the university.
The involvement of the CC in both forms of ICT development/acquisition, in some degree allows the CC to advise on price, compatibility with existing UDSM system/infrastructure and the availability of technical support within UDSM. With a limited budget for the acquisition of common infrastructure (such as computers, fibre optic cabling for the main backbone, and wireless technology) and the decentralization in academic units, UDSM has difficulties in maintaining standards across the university and this in turn strains the capacity of the limited amount of staff. Given the dispersal of acquisition and procurement functions such as ICT selection, cost evaluation and delivery and the difficulty of relating donor contributions to overall university requirements, there is a need for a more systematic approach that would bring centralized and decentralized acquisitions within a single inventory.

Concerning ICT - Implementation
The University Computer Centre is the main implementation agent of ICT within the university, from hardware and software to communication facilities. Applications are also implemented by suppliers under co-ordination of a project committee, which is chaired by the department owning the application and receives technical support from the Computer Centre.

University units handle their own implementation, with the involvement of vendors, and sometimes with the involvement of the CC. In some cases units handle their implementation directly with the vendors without the involvement of CC. Without common ICT implementation procedures such as project management oriented procedures, establishment of agreements on levels of ICT services to be provided by suppliers, and training programmes for the user organizations, it is difficult to monitor the performance of the implemented systems and to ensure maximum benefit from scarce resources for systems support. The absence of good system documentation can also complicate support and troubleshooting.

Concerning ICT - Utilization
The number of projects related to and/or using ICT is growing every year, and with it the number of users. The ICT spread is mainly PC based for academic and administrative processes. Each faculty and college has a public access room and computer laboratory to serve students and academic staff. These are the areas of most concentrated ICT use. Incorrect user behaviour, insufficient cost consciousness, insufficient interaction of users with service providers, and insufficient skills and knowledge on the part of the different user groups are some of the weaknesses in ICT utilization in the UDSM. More effective management of the flow of users could expand the ICT user population within UDSM, but more realistic assessments of training needs and costs are also required.

Concerning ICT - Service Management
ICT service management at UDSM is mainly centralized at CC, although some faculties attempt to support their own ICT up to a certain level. A formalized procedure between the CC and faculties and administrative units in relation to support of the utilization of ICT has not been established, nor mechanisms for the realization of relevant management processes and qualification aspects of service management. Service management could be improved if management tasks and responsibilities were more clearly defined and understood throughout the university. The relationship of CC as a company with UDSM regarding ICT services should be finalized and revised regularly. The CC has introduced the concept of a business-oriented unit, keeping its own profits, in such a way that staff can be maintained and a professional relationship can be established with the university’s academic and administrative units.
Information about UEM was obtained from UEM annual reports, strategic plan, other publications, www.uem.mz and field assessment, and was verified by the Director of CIUEM.
7. ASSESSING THE UNIVERSITY EDUARDO MONDLANE (UEM) MOZAMBIQUE

Introduction
The objective is to assess the Big ICT Five in the University Eduardo Mondlane (UEM) by applying the models presented in Chapter 4. For the assessment we will follow the outline presented in Section 4.3 of Chapter 4.

7.1 Subjects and objects for assessment of the entity Real System using the MCM paradigm

In relation to the entity Real System, we focus on the following subjects and objects:
- Historical background
- Location
- Organization
- Services
- Administration supporting education, research, and services
- People
- Situational Factors

Historical Background
Eduardo Mondlane University (UEM) was founded on 21 August 1962 as General University Studies of Mozambique. In 1968 it was promoted to full university status, and its name changed to the University of Lourenço Marques (ULM). During this period, the university was geared, in terms of both its student population and its curricula, to serving the interests of the colonial power.

In 1975 Mozambique became independent, and in 1976 the ULM was renamed Eduardo Mondlane University (UEM). Although it is still a young university, it is the oldest in the country and was the only one until the mid-1980s.

Location
The University has 15 academic sites, located in a radius of 7 Km within Maputo, the capital of Mozambique. They range from a main campus with six faculties to one building used as a veterinary hospital. Such dispersion of the university brings with it delays in university transactions and also additional costs for the university operations and activities.

Organization
Organizational structure. The organizational structure of UEM can be fitted into the Mintzberg logo as illustrated in Figure 7.1.1.
Education and Research. Education and Research activities are undertaken within faculties/departments and Research and Service Centres. Education and research in the area of ICT takes place at the Department of Mathematics and Informatics (DMI) of the Faculty of Science. The curriculum of DMI includes computer science courses. The Engineering Faculty contains the Electro-technical Engineering Department (DEEL) whose curriculum includes computing-related disciplines. None of the courses include ICT management. The programme in these departments (DMI and DEEL) has been reduced from five to four years and delivers a Licenciatura degree.
The university and the outside market for ICT implementation absorb the graduates of both the DMI and the DEEL. In total, about 30 graduates per year are produced by these departments - a very small number in comparison to the real needs for human resources to deal with issues of ICT development, ICT implementation, and ICT utilization. Research so far undertaken by the university has been aimed at supporting the teaching and learning activities. The academic and non-academic staff directly involved in teaching-learning, research and extension services are attached to faculties and centres, as shown in Table 7.1.1.

<table>
<thead>
<tr>
<th>Faculties (F1 - F11), Centres and Units</th>
<th>Courses</th>
<th>Staff</th>
<th>Non-Academic</th>
<th>Student population</th>
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</table>
| **F1. Faculty of Agronomy and Forest Engineering** | Agronomic Engineering  
Forest Engineering  
Rural Engineering  
Plant Production  
Rural Extension | 61  
104 | | 648 |
| **F2. Faculty of Architecture and Physical Planning** | Licenciatura in Architecture and Physical Planning | 25  
27 | | 215 |
| **F3. Faculty of Sciences** | Biology  
Geology  
Physics  
Mathematics and Informatics  
Chemistry | 146  
186 | | 230  
174  
199  
295  
182 |
| **F4. Faculty Law** | Law Science  
Law and Economics | 49  
29 | | 891 |
| **F5. Faculty of Economy** | Economics  
Management | 49  
32 | | 695 |
| **F6. Faculty of Education** | Curricula Development  
Natural Science and Mathematics Education  
Adult Education  
Psychology | 15  
1 | | 25 |
| **F7. Faculty of Arts** | Geography  
History  
Linguistics | 81  
49 | | 194  
266  
244 |
| **F8. Faculty of Medicine** | Medicine | 130  
106 | | 664 |
| **F9. Faculty of Engineering** | Civil Engineering  
Electrotechnical Engineering  
Mechanical Engineering  
Chemical Engineering | 104  
113 | | 403  
467  
420  
293 |

Table 7.1.1 - Academic, non-academic and student population breakdown by units and courses offered by UEM, 2000
Table 7.1.1 (cont.) - Academic, non-academic and student population breakdown by units and courses offered by UEM, 2000

The on-going curricular reform aims to design academic curricula responsive to the real needs of the country and the challenges imposed by the globalisation process. Such reforms influence the duration of undergraduate courses, which have now three possible durations of between 3 and 6 years. Post-graduate programmes include Master’s degrees after 2 years and PhDs of between 4 and 5 years. The PhD programmes are implemented in conjunction with universities from outside Mozambique. UEM is introducing a credit system under which students can pursue a modular form of studies. UEM is also increasing its student intake and graduation by introducing distance education and by increasing the number of education infrastructures. While keeping small libraries in departments/faculties, the university is establishing a central library under a rationalisation of resources. Most of the 11 faculties contain each at least one small research and services centre. These centres act as interfaces between the respective faculties and university outreach activities.

Services
The university provides a number of services that directly or indirectly provide support its main mission of education and research. These services include:

Transport. (42 staff) The University provides transportation services to the students, academic and administrative staff by allocating buses that are run by a university administrative unit (Directorate for Administration of Assets).

Library. The university academic units each run their own library. The Directorate of Documentation Services provides books and international publications and journals for distribution in the campus and Internet access for students. It is involved in the development of central library activities.

Security. (303 staff) The University has a security unit (Protection and Security Unit - UPS), which is mainly responsible for safeguarding UEM assets.

Social Services. (179 staff) The University runs social services for students that include accommodation (1,112 beds) and provision of food (an average of 2480 meals per day).

Housing. (15 staff) The University manages housing facilities for academic and administrative staff.
ICT. (70 staff) – The University has an Informatics Centre (CIUEM) which provides ICT services to the University. CIUEM also provides ICT services to organizations outside the university, from which it collects most of its revenue.

Administration supporting education, research, and services
The organizational chart of UEM’s administrative and managerial structure - the Officers of the University (Rector and two Vice-Rectors), University Council, Academic Council and the Council of Directors - is presented in Figure 7.1.2.

The Rector is the main authority within the university and is responsible for the administration of the whole university. In his duties he is assisted by two Vice-Rectors, one (the Vice-Rector for Academic Affairs) is responsible for the coordination of academic affairs, and the other (the Vice-Rector for Administration and Resources) for the coordination of administrative issues.

Under Academic Affairs, the Scientific Directorate centralizes the administration of the university’s scientific issues and provides support to faculties in scientific matters.

The Pedagogic Directorate centralizes the administration of pedagogical issues and provides support to faculties in pedagogical matters. For example, the university can only approve the introduction of new courses with a positive recommendation from the Pedagogical Directorate.

The Academic Registry Directorate centralizes the academic and student administration in relation to academic issues and provides support to faculties. Student Administration starts as soon candidates pass university entrance exams and become university students. A faculty administrates the academic life of students and provides information to the Academic Registry Directorate as needed.

The Documentation Services Directorate supports the whole university in the acquisition and distribution of books, journals, and documents.

Under Administration and Resources, the Administration and Patrimony Directorate provides support to and administration of the university patrimony, acquisition of assets and their distribution/allocation and security. This directorate shares with the Finance Directorate the administration of acquisition of goods and their regular inventory. Acquisition of hardware and software is formalized, but in general procedures for acquisitions do not comply with the recommendations of the strategic plan, with disadvantages for the university.

The Finance Directorate centralizes the administration of university finances and provides support to the whole university on finance administration matters.

The Press and Bookshop provides services to the university in its areas. The acquisition of books is formalized, but in general, procedures on acquisitions do not comply with the recommendations of the strategic plan, with disadvantages for the university.

The Human Resources Directorate centralizes the administration of university staff and provides support in issues of human resources administration. Together with the Finance Directorate it administrates the university payroll. Weakness in human resources management, mainly at faculty level, prevents the university from making full use of staff.

The Social Services Directorate provides support to students in social matters.

The university’s Physical Infrastructure Unit (GIU) centralizes the administration of new construction and maintenance of the university’s physical infrastructures.
The daily administrative activities are being improved through reforms aiming to provide the university with modern management tools that will enable better support to the main mission of the university. As part of the ongoing processes under the UEM strategic plan and the ICT strategic plan, three main administrative reforms (on University Management and Administration, on Finance Management, and on Human Resources Management) are underway (see Figure 7.1.3). In this figure we outline the three major processes which are providing the main guidelines for university development: the university strategic plan, the ICT strategy and, as a consequence of these, the reforms being undertaken within and outside university to allow a better implementation of the two strategies.

In relation to ICT strategy, University Eduardo Mondlane approved its first information policy plan (IPP) in 1992. The basis for the development of the IPP in 1992 was the University Development Plan (Present and Perspectives) and the governance principles established in 1990/92. The main issues covered by the five-year IPP were: (a) ICT for academic support; (b) ICT for administrative support; (c) strengthening of the IT unit (CIUEM) and the development of a master plan for the implementation of the IPP. Under
these headings, one of the major issues then tackled was the need for an ICT Master Plan, covering standardization of key administrative information systems such as the Academic Registration Information System, Personnel and Payroll Information System, Library Information System, Finance Information System, Contract and Project Management System, Service Information System, Management Information System, electronic mail service, and a common infrastructure including telecommunications facilities.

**Strategic Objectives**

- To achieve administrative and management efficiency in the context of university autonomy
- To guarantee excellence and quality
- To develop financial sustainability
- To develop the physical structure
- To stabilize and develop human resources
- To increase the rate of enrolments
- To improve social conditions
- To guarantee gender equity
- To develop national and international co-operation
- To enhance the academic environment
- To advertise and promote the image of the university
- To guarantee continuity of the strategic planning process

**Strategic Objectives**

1. Priority areas for ICT
   1.1. ICT applications areas
      1.1.1. Teaching and learning
      1.1.2. Research and Extension
      1.1.3. Academic information services
      1.1.4. Administration and management
   1.2. ICT technical and support infrastructure
      1.2.1. Technical infrastructure
      1.2.2. ICT Services organization and responsibilities
      1.2.3. ICT services cost and budget
   1.3. ICT services at natural level
      1.3.1. CIUEM
      1.3.2. Distance Education
   1.4. Risks and strategies to reduce risks
   1.5. ICT organizational structure
      1.5.1. University Council
      1.5.2. Computer Steering Committee
      1.5.3. Information Services Officer
      1.5.4. University units and Faculties (including the libraries)
      1.5.5. Central ICT services organization (CIUEM)
      1.5.6. Project/Users groups

**Reform of University Management and Administration (RUMA)**
- Reform of University Management and Administration (RUMA)
- Financial Management Systems
- Higher Education Sub-system
- Curricula
- Human Resources
- Legal Framework

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<td>Financial Management Systems</td>
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<td>Higher Education Sub-system</td>
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<td>Curricula</td>
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<td>Human Resources</td>
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<td>Legal Framework</td>
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Figure 7.1.3 - Ongoing Processes at UEM
Chapter 7 – Assessing the University Eduardo Mondlane (UEM) - Mozambique

The ICT Master plan covered planning the implementation of the information systems identified in the IPP, identification of the activities to be performed in relation to the planned information systems, costing of the activities, human resources training, and coordination mechanisms. As a consequence of the implementation of the ICT Master Plan, the Academic Registration Information System, Personnel and Payroll Information System, Electronic Mail and Internet were developed. Office automation was widely introduced and computer networks were developed. CIUEM was established as the university MCM services unit. The decision made to establish ICT policies for individual faculties was not implemented, mainly because of a lack of the skills required to develop such policies at the faculty level. The issue of human resources development was not properly addressed and this had repercussions throughout the life cycle of the different information systems.

While standardization of ICT was strongly recommended for the administrative systems, for the academic area only guidelines were provided. There was no mechanism for the enforcement of standards, guidelines and procedures. Financial resources mobilized from donors and from government funds for the implementation of the IPP were not sufficient for the planned period of five years.

A new ICT Strategic Plan 2001 - 2005 is now available. This ICT Strategic Plan has followed the same path as the previous plan, identifying issues to be addressed without stating how such issues will be dealt with. For example, it covers priority areas for ICT, such as teaching and learning, research and extension, academic information services and distance education. It also covers new areas such as ICT services organization and responsibilities, costs and budget. It introduces the concept of implementing ICT activities within project/user groups. In this concept, user units are clustered and working groups are made from those units. This can contribute to improving the level of knowledge among users. Risks to the implementation of the strategy, and strategies to reduce risks have been outlined. At the time of our research, however, the impact of the new ICT strategy had not yet been felt.

We observe that implementation of the first ICT plan was compromised by lack of skills and financial resources. These two constraints are part of the real system and need to be acknowledged in the planning process. A less ambitious plan that can actually be implemented is much more valuable than a “perfect plan”.

The Reform of the University Management and Administration (RUMA) aims to establish an organizational structure, processes and procedures responsive to the demands of the new curricula. This reform has raised considerable discussion on the issues of decentralization and reallocation of functions and responsibilities at different levels of the university. Decentralization is needed both in the academic and administrative areas of the university. RUMA is therefore concentrating on a new organizational structure, including aggregation of units; transfer of functions from one level to others; rationalization of both academic and non-academic personnel in a Human Resources Plan; and establishment of a programme to remove from the university’s daily management those areas that are not part of the main mission of the university (such as housing management).

The Reform of the Finance Management System (RFMS) aims to respond to the demands of the new organizational structure, with more transparent processes for utilization of funds, and procedures for budgeting and allocation of financial resources by activity and by university unit. In this regard, the budgeting process starts with all university units preparing their plans of activities together with the estimated budget needed for realizing these activities. At the central level all requests are consolidated as one budget, which is then sent to the government. Each year the plan of activities is approved, but usually the financial resources allocated to the university are less than the needs, despite successful efforts to increase the number of graduations (445 in 2000, 696 in 2001 and 606 in 2002) and student intake (950 in 2001, 1299 in 2001 and 1419 in 2002). In 2001 the university received USD 21.5 millions from the government for the implementation of its plans, 33% less than its needs. In 2002, UEM received 52% less than its financial needs and in 2003 it will receive 37.5% less than its real
needs. The university's strategy is being implemented but funds are being reduced. A breaking point may be reached and many activities may have to be dropped.

The Reform of Human Resources Management aims at optimal allocation and use of the university's human resources. Under this reform, training programmes are planned for academic and non-academic staff. Contracting of staff is tightly controlled and limited to extremely necessary newly qualified staff. Formal procedures for staff recruitment are tightening.

**People**

Academic staff, non-academic staff and students of UEM form the UEM population. The university population can be expressed as follows:

- **Numbers.** UEM has 800 academic staff and 960 technical and administrative staff involved in education and research, plus 903 support staff. UEM has 8204 students.
- **Education.** 100% of academic staff have higher education. 15% of technical and administrative staff have completed a university degree. 2% of support staff have completed a university degree.
- **Experience.** More than 88% of the staff in the three groups have six or more years of working experience, although 24.75% of academic staff have less than 2 years experience. 56% of the experienced academic staff do not have a PhD.
- **Personnel Turnover.** The personnel turnover is very high. Most staff who receive training or further education overseas return to the university. Many staff have other paid jobs outside the university, which do not allow them to devote all their time to the university.

**Situational Factors.**

- **Specific situational factors.** Culture of the university and the Starting point for ICT.
- **Culture.** The university is open to students from all social classes and from all provinces. Admission to university courses is based on scientific merit of the applicants. Members of the collegial organs of the university are elected and major decisions of the university are made by these organs. The university strives to offer opportunities for more academic qualifications for its staff. In every year since 1975, at least has one third of UEM staff have been on training programmes. There is no discrimination of any form, but there is a very great competition for access to financial and material resources. There is a perception that access to resources is gained through power.
- **Starting point for ICT.** ICT has been in use at UEM since the 1970s. At first UEM had an IBM punched-card-based computer that allowed students to learn and exercise programming skills, mainly for mathematics students. In the 1980s the University introduced Digital Equipment Corporation's Minicomputers. This phase also included students from engineering courses. In the middle of the 1990s, the worldwide explosion of Personal Computers (PCs) also affected UEM and by the end of the decade most of the university's academic units had a computer lab with at least 10 PCs, ranging from XT's to the most advanced PCs, depending on the nature of the academic unit. The Faculties of Engineering and Science have always had the most advanced computing power. To date the university has kept pace with technological change and ICT is spread throughout the campus.

- **Generic situational factors.** ICT suppliers relationship and discontinuity of management
- **ICT suppliers' relationships.** Relationships with ICT suppliers are of an ad-hoc nature.
- **Discontinuity of management.** 165 academic staff (20% of the total) are involved in university management and administration. Rotation of leaders in the academic units (faculties/departments) takes place every three years. In some cases this
creates discontinuity of management, which can influence negatively the implementation of the university strategy.

Conclusions
Education and research at UEM also covers education and research in the area of ICT. In the ongoing internal reforms the university has revised its IPP, which has now become the UEM ICT Strategic Plan. In the review process, it became clear that most of the aspects covered by the IPP are still valid. However, a decision was made to put more emphasis on teaching and learning, research, academic information systems and distance education - priorities which clearly show the university’s intention of using ICT to support its core business. In its ICT strategic plan, UEM is also paying special attention to other strategic issues such as costs, budgeting and decentralization of ICT services, and ICT management. The latter was not properly addressed in the previous IPP and this contributed negatively to ICT implementation. As in the previous IPP and its implementation plan, the ICT strategy covers some relevant strategic issues but certainly leaves out others such as ICT security. The university’s daily activities are not addressing many of the strategic issues covered, and a better understanding is needed of the purpose of an ICT strategy, its implications and the financial and skills constraints within which it must be implemented.

7.2 Subjects and objects for assessment of the entity ICT using the MCM paradigm

In relation to the entity ICT, we focus on the following subjects and objects:
- Complexity factors
- Hardware/Software/Communication characteristics
- Datasets’ characteristics
- Procedures’ characteristics

Complexity factors
Quantity. 935 PCs, a number of communication facilities, 4 operating systems and 18 applications software packages are available. ICT within UEM is growing, with an increase in new information systems, computer labs and Internet connection points.
Diversity. UEM has various types of ICT components from different manufacturers and origins. This forces the university to have relationships with many ICT suppliers.
Distribution. UEM has its ICT dispersed throughout its different locations.
Dynamics. Changes in hardware and software take place slowly. The staff of CIUEM, faculties and ICT suppliers introduce changes in hardware and software on an ad-hoc, uncontrolled basis.
Functionality. ICT is employed for different functions within UEM.
Relationships. There is a university ICT network. However, the administrative systems are not linked to this network.
Ownership. The university owns the ICT. The Rector has delegated some of his responsibilities to the heads of academic and administrative units. The delegation of responsibilities also includes responsibility for the ICT allocated to the units.
Utilization. In each academic or administrative unit the users utilize the ICT available. Academic staff and students access and utilize ICT differently from administrative staff. While academic staff and students use the available ICT freely for their specific individual needs, administrative staff apply ICT only for specific tasks. For example the staff of the Finance Directorate can only use ICT in the Finance Management Information System.
Sophistication. The University ICT is very advanced. Very few of the university staff have enough knowledge of the available ICT, which makes it difficult for them to understand it and to use and/or service it properly.
To illustrate the complexity of the ICT at UEM we refer to Figure 7.2.1, which shows the variety/diversity in communication facilities. Table 7.2.1 gives information about the capacity of these communication facilities.

**Hardware/Software/Communication characteristics, such as:**

**Network capacity.** The university campus and sites outside the campus are all connected via fibre optic cable and a radio link. The installed network capacity varies among the buildings and campuses from 10 to 100 Mbits. The international link varies between 128k and 384 kbits. CIUEM is the main hub for the international link with a 128 kbits uplink and a 1Mb downlink to USA via PanAmSat to MCI. This is an unbalanced link because the cost of a balanced one is unaffordable. CIUEM provides hook-ups for all the university sites, combining wireless and dial-up technologies. Sites outside the main campus use wireless technologies. The wireless technology is a private network and belongs to the university. The dial-up connections are made via the Public Telephone Operator.

<table>
<thead>
<tr>
<th>Type</th>
<th>Topology</th>
<th>Capacity</th>
<th>Beneficiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Backbone</td>
<td>Fibre optic</td>
<td>100 mbps</td>
<td>Main &amp; Engineering Campus</td>
</tr>
<tr>
<td>Local Area Networks</td>
<td>UTP</td>
<td>10/100 mbps</td>
<td>Faculties</td>
</tr>
<tr>
<td>Metropolitan Network</td>
<td>Wireless</td>
<td>Tree-Topology</td>
<td>UEM</td>
</tr>
<tr>
<td>Wireless Technology</td>
<td>802.11 DSSS</td>
<td>Point to Point and Radial Star</td>
<td>11 mbps</td>
</tr>
<tr>
<td>Internet</td>
<td>VSAT</td>
<td>Point to Point</td>
<td>384/128k</td>
</tr>
</tbody>
</table>

Table 7.2.1 - Communication Facilities Capacity, UEM, 2001

**Standardization.** Planned standardization of ICT is far from being implemented.

**Quality of technical facilities.** The technical facilities are of high quality, up to date with the latest market releases and versions.

**Datasets characteristics, such as:**

**Extent.** The existing databases are of small and medium size, a few hundred megabytes each at the Finance Information System, Student Records Information System and Payroll and Personnel Information System.

**Standardization.** Planned standardization of ICT is far from fully implemented. There is little standardization of databases.

**Database management software.** Oracle and Access database management software are applied within UEM.

**Procedures’ characteristics, such as:**

**Number.** The total number of procedures is not known.

**Extent.** Procedures are based on existing practices. Few are written down.

**User friendliness.** The existing written procedures are very descriptive. The entities issuing such procedures are not very concerned about their user-friendliness.

**Language.** The existing procedures are mainly written in Portuguese, the official language. However, most of the technical documentation is written in English.

**Conclusions**

UEM has a huge quantity of ICT infrastructure and components. The available ICT are of many types and from different manufacturers and origins. A good understanding of this highly complex ICT infrastructure is required, and so are well-defined user groups. Professional ICT service management is also needed to support the implementation and utilization of the ICT in accordance with requirements, pre-conditions and situational factors of the University, so as to influence the university’s core business in a positive way.
Figure 7.2.1 University Eduardo Mondlane infrastructure, 2001
7.3 Subjects and objects for assessment of the entity MCM using the MCM paradigm

In relation to the entity MCM, we focus on the following subjects and objects:
- Organization
- Tasks with reference to tasks areas and task fields
- Processes
- Procedures
- People

Organization
The Management, Control and Maintenance (MCM) of the ICT supporting the university is centralized in the University Informatics Centre (CIUEM). Some MCM activities are also undertaken by some faculties (such as Engineering and Agronomy), external ICT services (such as the national PTO – TDM and the public electricity company - EDM), international Internet suppliers MCI and L&B, and ICT consultants.

CIUEM operates as an ICT services unit for the entire university. The ICT Strategy states that UEM’s major objective for CIUEM is that it supports UEM as a whole in the process of ICT planning, deployment, training, management and maintenance. In this regard, CIUEM provides:
- advice and support to UEM units during ICT planning and development stages;
- procurement and installation of ICT hardware and software;
- technical ICT implementation, maintenance and support services;
- user training;
- provision of similar services outside the university.

Within CIUEM, these activities are undertaken through specialized units and staff as indicated in Figure 7.3.1.

![Organization Chart of CIUEM](image)

Figure 7.3.1 Organization Chart of CIUEM

The 70 staff of CIUEM are organized to perform MCM functions within the following departments:
- System and Operations Department (SOD): this department is responsible for Internet provision (including Internet country domain administration, IP installation
and configurations) to the whole university and to external users, and for Operating Systems (including installation and administration of networks and stand alone operating systems for multi-use and stand alone systems).

- Software and Application Department (SAD): this department deals with database development and administration of the database management systems. It is also responsible for systems analysis, software design and implementation and the customization and maintenance of applications packages.
- Computer Maintenance Department (CMD): this department deals with computer hardware planning, testing, installation and maintenance. CMD activities include hardware repair both for stand-alone and networked computers.
- Information Services and Content Development (ISCD): this department deals with the provision of services related to WEB design and maintenance and hosting.
- Services Control Department (SCD): this department deals with management and administration of the services provided by CIUEM to its various clients. It performs functions such as Configuration Management, Help Desk and ICT service management.
- Training Department (TR): this provides end-user training on the Internet and other ICT courses for users, managers and technicians.

The Director provides strategic direction and is not involved in operational or technical management, which is the responsibility of the head of the Services Control Department, together with the heads of the technical support departments (CMD, SOD, ISCD, SAD and TR).

**Tasks**

According to the summary of the MCM paradigm and the Three Kinds of MCM/Expansion Models presented in Chapter 4, management tasks can be found and performed within the MCM entity of the MCM paradigm and within the Three Kinds of MCM, forming Functional Management (FM), Application Management (AM), Technical Management (TM). In the entity MCM, such tasks are realized in more than one organization. Within UEM, CIUEM performs most of the TM, with a certain level of organization and some experience. AM and FM are weakly performed. In section 7.7 all tasks and the organizations that carry them out will be described in further detail by using the model Three Kinds of MCM.

**Processes**

**Incident Management.** Incidents are logged into the existing Helpdesk. The Helpdesk is located at CIUEM. On-line support services for logged incidents is provided by qualified CIUEM staff. When the incident cannot be managed by phone, CIUEM technical staff are sent to the client for in-depth investigation and restoration of services. In general most of the incidents reported are cleared. Solutions provided are not always recorded.

**Problem Management.** CIUEM staff realize some form of problem management. In general, problems are solved, but without going to their root causes. Consequently problems recur sometime later on. Thus problem management is not dealt with professionally.

**Change Management.** New ICT is acquired and as a consequence some form of Change Management takes place. Staff of CIUEM, faculties and ICT suppliers perform some change management on an ad-hoc, informal basis.

**Configuration Management.** Occasional configuration management for hardware and software takes place. In general CIUEM, faculties and administrative units undertake ICT acquisition independently. Sometimes, however, these units acquire ICT through CIUEM. Sometimes donations are made directly to CIUEM or to other units within the university. This makes it difficult to maintain a university-wide inventory.

**Release Management.** No release management takes place.
Chapter 7 – Assessing the University Eduardo Mondlane (UEM) - Mozambique

SLA Management. Service Level Agreement Management is of a very low level. SLAs are not formalized in agreements with UEM entities. This leaves room for accusations of lack of performance by the parties involved.

Capacity Management. Faculties and CIUEM perform some capacity management on an ad-hoc basis.

Contingency Management. No contingency management is carried out.

Availability Management. Some sort of availability management exists.

Cost Management. Some sort of cost management is done.

Network Services Management. Network services management is performed by CIUEM.

Procedures in written form, in verbal form

Most of the procedures for the realization of MCM tasks are orally communicated. A limited number of the procedures performed by CIUEM and external ICT service suppliers are in written form in Portuguese, the official language. The support documentation consists mostly of the technical and user manuals/documentations supplied together with hardware and software and written in English.

People

Number. Around 100 people from CIUEM, faculties and external ICT suppliers realize MCM tasks in one way or another.

Education. Around 15% of staff performing MCM tasks have some understanding of them; the majority of these are with CIUEM.

Experience. Around 10% of staff dealing with MCM tasks have many years of working experience in their field of ICT operation. This number is insufficient to handle all the service management needed in a professional manner.

Personnel Turnover. University staff with MCM skills can easily obtain well-paid jobs outside the university. With the exception of the ten most experienced CIUEM staff, staff tend to leave the university as soon as they have acquired enough experience and have done a certain number of ICT courses.

Conclusions

The MCM at UEM is centralized at CIUEM, which therefore plays an important role in the realization of MCM tasks. Faculties and external ICT service suppliers also perform some MCM tasks, but not all MCM processes are covered and those that are, are not performed at an appropriate level. SLAs are not formalized and few procedures are in written form. Most of them are orally stated. Relationships with ICT service suppliers occur on an ad hoc basis. ICT service management still leaves out many MCM tasks which need to be performed professionally, systematically and appropriately to support the university’s key tasks.

7.4 Subjects and objects for assessment of internal relationships using the MCM paradigm

In relation to the internal relationships, we focus on the following subjects and objects for assessment:

Relation RS → ICT. Requirements and preconditions
The university exploits the Student Records Information System, Payroll and Personnel Information System, the Finance Information System, and EMUnet for its own benefit. Requirements and preconditions for these ICT have been formulated. The lack of skilled users and training programmes to improve skills prevent the university from getting the best out of its ICT.

Relation RS ← ICT. Way of support
The Student Records Information System, the Payroll and Personnel Information System, the Finance Information System and EMUnet support the university in its activities in relation to students, staff, finance and education and research. It is not always possible to extract the
information generated by the ICT when needed because of the limited number of qualified users.

**Relation ICT → MCM. Kind of data to support MCM**
The Student Records Information System, the Payroll and Personnel Information System, the Finance Information System and EMUnet support the technical staff of CIUEM and of ICT service suppliers by supplying them with data. The advanced ICT and lack of skills on the part of staff do not always allow proper interpretation of the data generated by ICT.

**Relation ICT ← MCM. Way of management**
Technical staff of CIUEM and suppliers provide support to the available ICT in collaboration with the user departments of the Student Records Information System, the Payroll and Personnel Information System, the Finance Information System and EMUnet. Because AM and TM tasks are not carried out and the available data are sometimes interpreted wrongly, in many cases situations are created where decisions are not supported by the data provided.

**Relation RS → MCM. Requirements and preconditions**
The university employs CIUEM’s technical staff to manage the Student Records Information System, the Payroll and Personnel Information System, the Finance Information System and EMUnet. In this relationship the university has not established a detailed SLA stating requirements and preconditions to be fulfilled by CIUEM, as indicated in the ICT strategy.

**Relation RS ← MCM. Way of support**
Technical staff of CIUEM respond to users’ requests within the university. There are no formalized SLAs governing such requests. CIUEM has made some attempt to design SLAs, but unfortunately they have never become formalized and so units within university are not bound to them. CIUEM staff respond to requests as part of their duties as employees of the university. The prevailing perception within the university is that if SLAs were signed, the rest of the university units would not be able to afford the services of CIUEM.

**Conclusions**
The university has formulated requirements and preconditions for the existing ICT. The university is supported by the existing ICT in the realization of its activities. The areas covered by ICT support are clearly defined. However, lack of skilled users prevents proper utilization of ICT and the university cannot fully exploit the ICT it possesses.

The shortage of qualified people who understand the sophisticated ICT also prevents units performing MCM tasks related to application management and technical management from taking timely decisions based on the data which is generated by the ICT. This creates weaknesses in ICT service management.

UEM has not established formalized service level agreements with units employed by the university to perform MCM tasks. Requests made for ICT services are handled on an ad hoc basis. Without service level agreements setting out strategic issues such as what services are to be delivered, at what level and at what costs, the ICT service management requested has not been provided. Attention needs to be given to the issues which are not well covered in the ICT strategy. Payment for services, for example, seems to be the main reason for not establishing service level agreements. However, the cost of not having such services can be even higher.

**7.5 Subjects and objects for assessment of the external influences using the MCM paradigm**

**Economy**
Mozambique is rated as one of the poorest countries in the world [ACR2000]. The university, including ICT applications within it, is one of very many legitimate claimants on the national
budget and for donor funds. The cost of bureaucracy is very high, resulting in a less attractive environment for investors in general and in particular for investors in the area of ICT.

The consequence of very limited internal human and financial resources for ICT is frustration within the small, skilled ICT community at the slowness with which ideas can be implemented; it also means that those experts spend an inordinate amount of time fundraising to ensure that some ICT development can take place. They are also subject to pressures from donors, who do not necessarily share national priorities outlined in national institutions’ strategies. Often programmes identified as important by national institutions must be reshaped to fit donor agendas. Clearly, the high dependency on external financial resources negatively influences the implementation of institutions’ strategies.

**Education**

Human resources to implement, use and support ICT within the university are extremely limited. There are very few people within the country with the technical and management skills needed for successful ICT implementation in UEM. UEM strives to keep the qualified staff that it has trained. However, the market outside the university pays more and thus attracts many qualified staff. Staff have been trained both in Mozambique and outside the country (America, Europe, Africa, Asia), providing different and unbalanced levels of skills in the ICT field. Many expatriates in Mozambique teach ICT in schools and universities, each from the point of view of his or her own culture.

The limited human resource base makes it difficult to maintain staff at UEM. It also makes it difficult for the university to contemplate playing a full part in the global knowledge society, which is the frame within which much discussion with donors takes place.

**Governance**

The relationship between UEM and the government is illustrated in Figure 7.5.1. Relation 1 indicates the relation between the university and the Head of State (President assisted by the Prime Minister). The President nominates the Rector and Vice-Rector on a political basis. Relation 2 is the relation between the university and the Prime Minister (PM). Relation 3 is with the Ministry of Planning and Finance (MPF). The university presents its annual plan and budget to the MPF. The university reports on activities and financial expenditures to the MPF on a monthly basis. Relation 4 is the relation with Ministry of State Administration (MAE). University staff are part of the civil service and are governed by the public sector principles. In this relation there is also the Administrative Tribunal for the formalization of staff contracts. Relation 5 is with Ministry of Higher Education Science and Technology (MESCT). This ministry’s functions include definition of policies for and harmonization of the sector of higher education in Mozambique.

In a multiple relationship such as this the absence of a clear set of policies, defined procedures and identified processes can produce ad-hoc decisions that influence development of ICT within university.

External rules tend to serve as frameworks and in general they do not take into account the specifics of UEM. Its close relationship with the government means that decisions on the university are not always within the purview of the university management - they have a political dimension and can also be delayed by bureaucratic processes.
All this contributes negatively to the effective implementation of university programmes and projects.

**Donors:**
The major donors working with UEM in the ICT field are: Nuffic - Netherlands; SAREC/SIDA - Sweden; The World Bank; UNESCO; The Ford Foundation – USA; Kellogg Foundation – USA; and IDRC/Acacia - Canada. These donors finance most ICT projects, providing only capital investment and with no interest in providing funds for the running cost of the acquired ICT. In some cases they provide ICT as donations. Donors support ICT acquisition rather than the creation of capacity and skills for local ICT development, even though locally developed ICT may provide more appropriate and sustainable technological solutions, as is the case for content development in local languages.

The donors’ efforts complement the financial resources provided by the Government. Procedures for ICT acquisition are not the same for all donors, because of the different financial management and reporting systems and the different policies of each country or donor organization regarding ICT deployment. As a consequence, management of ICT acquired through donors is complex and the sustainability of projects cannot be guaranteed.

Because of its history, its levels of poverty, its current political climate and the commitment of its leaders to applying ICT to stimulate development, Mozambique is very popular at the moment among ICT donors. The small number of skilled ICT managers have to respond to numerous requests for project development. The promotional activities of donors can draw resources away from national ICT objectives and disperse the small concentration of skills. The high dependency on external funding does not encourage proper expenditure planning, distinguishing between capital investments and running costs and identifying donor contributions to each.

Some donors frequently organize ICT promotional activities in different parts of the world which have little impact on national activities. The promotional activities of donors draw resources away from national ICT objectives and disperse the small concentration of skills. This contributes to delays in ICT implementation and also gives less time for the few skilled staff to provide professional ICT services to support the university and other national bodies with a certain level of quality.

**Technology and Suppliers of Technology:**
The major brand names of European, American and Asian hardware, software and communication technologies can be found at UEM and in Mozambique. The ICT industry in Mozambique is still in its infancy. Little software and no hardware is produced in Mozambique. Dealers are supplied mainly by companies based in South Africa or Portugal. These, in turn, source ICT from other markets.

Few of the dealers offer after-sales service and, when they do offer it, their services are regarded as expensive. There is little culture of selling ICT products with maintenance contracts. Lack of secure maintenance agreements results in increased risks that big investments will be held hostage to relatively small problems which cannot be addressed speedily. This was the case with the student record system and payroll systems, which could not be adapted to Y2K needs immediately.

TDM is a monopoly and the government is in the process of privatising part of it. TDM has established digital state-of-the-art technology, mainly between the provinces and Maputo, using satellite and microwave connections. A fibre optic project is underway to connect four of the provinces (out of ten) by the end of 2003. Cell phone services were available in at least six provinces out of ten at the beginning of 2002. However, the exchange of information among provinces is still a problem and an even greater problem is the exchange of information among districts.
Chapter 7 – Assessing the University Eduardo Mondlane (UEM) - Mozambique

The lack of competition enables TDM to maintain high prices and to set its own response times for installation and fault resolution. Expansion of the network in the provinces is slow and this hampers communication between UEM in Maputo and its decentralized faculties and field workers. Lack of an effective regulator to determine TDM targets and conditions for network expansion compounds this problem.

The government of Mozambique designed and approved the National Information Policy in 2000. In 2002 it approved the ICT strategy [http://www.infopol.gov.mz] in which a specific section deals with the issue of human resources development. Under this section, the Mozambique ICT Institute will be born, to serve, together with UEM and other education initiatives, as a catalyst for the education and research in the area of ICT. UEM as a member of the ICT Government Task Force plays an important role in the development of the National Information Policy and Strategy and also as a provider of technical solutions and technical advice.

Conclusions
UEM is governed by civil service rules and is influenced on a daily basis by the government. Decisions are not always within the purview of the university government; they have a political dimension and can also be delayed by bureaucratic processes, which influence negatively the implementation of the university strategy.

Mozambique still lacks qualified people. To minimize this problem, institutions such as UEM are encouraged by the government to send their staff abroad for post-graduate programmes. This results in staff having different competences and having been educated in different systems of education, which in turn influences the Mozambican higher-education system and its graduates. The level and quality of application and use of ICT by the staff in education and research activities is greatly influenced by where the staff received its education.

Mozambique is still very much dependent on external financing, and so is the university. This affects negatively the implementation of institutional strategies, which in many cases have good documents but little funding for the implementation of planned activities. Donors contribute greatly to financing ICT programmes but in many cases they pressure national institutions. Often programmes identified as important by national institutions must be reshaped to fit donor agendas. ICT acquisition, for example, is very much influenced by donor interests and this has a negative impact on the implementation of most ICT projects because important factors such as sustainability and skills building are not taken into account.

Major brands of European, American and Asian hardware, software and communication technologies can be found in Mozambique. Although the ICT components are still in the hands of few Mozambicans, they are already of high diversity and are widely distributed in the main towns. This imposes on Mozambique the need to invest in the establishment of professional ICT service management.

The government of Mozambique designed and approved the National Information Policy in 2000 and the ICT strategy in 2002. The policy and strategy will guide the ongoing activities in ICT and those to come. It is hoped that it will also cater for the development of a national ICT industry alongside the development of education and research in the ICT field.

7.6 Subjects and objects for assessment using the State Model/ Extended State Model

State Model/ Extended State Model subjects and objects
- University Network. (State(s) and tasks and processes)
- Local Area Networks. (State(s) and tasks and processes)
- General Information Systems
University Network
After a long and involving Planning State process, the States of Acquisition/Development and Implementation of EMUNet have been achieved. Being in use, EMUNet is now subject to various modifications, mainly to increase bandwidth, to introduce high-performance hardware and software with and to establish more Internet access points throughout the university. In the Extended State Model, EMUNet can be said to be in the Utilization State, Maintenance/modifications State and Exploitation State. Utilization is affected by low international bandwidth for Internet.

Local Area Networks
With regard to the Local Area Networks, the Planning State has been done in/for all buildings. In about 70% of buildings, LANs have been acquired/developed and implemented. In these buildings the LANs are in the Utilization and Maintenance/Modification States. Maintenance is undertaken more often than Modifications. The remaining 30% of the buildings are still to be financed for LAN acquisition/development.

General Information Systems
Payroll and Personnel Information System
The Payroll and Personnel Information System is in the States U, M1/M2.
In the Utilization State, the Finance Directorate runs the payroll subsystem and the Human Resources Directorate runs the human resources management subsystem in which activities such as data entry of new staff and staff absence are entered. This data is then used by the payroll subsystem. In the M1/M2 state, CIUEM staff and ICT services consultants are asked by the Directorate of Human Resources to introduce new functionalities. The changing of functionalities has been frequent since different government bodies often request information on Human Resources in different formats.

In the Extended State Model all states are clearly defined and they are to be undertaken separately. What is happening with the Payroll and Personnel Information System is in conflict with the Extended State Model because the two states are being done at the same time. The combination of the two states creates opportunity for conflicts between users and the developers and creates lack of confidence on the part of users.

Student Records Information System
The Student Information System is in the States U, M1/M2.
In the Utilization State, the Academic Registry Directorate runs activities such as entering data on new students, students’ academic performance and new courses. The Academic Registry Directorate then makes use of that data to produce information for various entities such as the top management of the university, the faculties, students and government bodies. In the M1/M2 state, the Academic Registry Directorate asks staff of CIUEM and ICT service suppliers and ICT service consultants from time to time to introduce new functionalities. Such requests are not frequent. In the Extended State Model all states are clearly defined and they are to be undertaken separately. Although modifications are not frequent, the combination of the two states creates an opportunity for conflicts between users and the developers and creates lack of confidence on the part of users.

Library Information System
The Library Information System is in the D State.
UEM has created a task force composed by senior members of the different libraries existing within the university and representatives of faculties and students to design terms of reference for the library system and to prepare a request for proposals. The team is also responsible for the selection process. The task force is now buying the selected application. The Directorate of Documentation Services is
co-ordinating activities in this State under the direct supervision of the top management of the university.

Finance Information System
The Finance Information System is in the U, M1/M2 States. In the Utilization State, the Finance Directorate runs activities such as accounting and entry and control of budget data. This data is then used by the Directorate of Finance to produce financial information for the top management of the university, academic and administrative units of the university, government bodies and donors. In the M1/M2 State, CIUEM staff, ICT service suppliers and ICT service consultants are asked by the Directorate of Finance to introduce new functionalities. Functionalities have been changed frequently to accommodate the ongoing financial reform in the Ministry of Planning and Finance and requests from donors.

In the Extended State Model all states are clearly defined and they are to be undertaken separately. What is happening with the Finance Information System is in conflict with the extended state model because the two states are being done at the same time. The combination of the two states creates an opportunity for conflicts between users and developers and creates lack of confidence on the part of users.

Assets Information System
The Assets Information System is in the IPP State. A task force is to be formed, for which the Directorate of Finance and the Directorate of Administration and Patrimony are developing the terms of the reference.

ICT-based Distance Education
The ICT-based distance education is in the IPP State. A task force and a distance education consultant have been appointed. A draft report/plan has been elaborated and is now waiting for approval.

University Management Information System
The University Management Information System is in the IPP State. A task force composed of directors under the coordination of the Vice Rector for Academic Affairs and the Vice Rector for Administrative Affairs and headed by the Director of Planning Office has been established to prepare a proposal for the terms of reference for such a system.

Conclusions
The EMUNet, which constitutes a centrally planned, developed/acquired, implemented and managed ICT infrastructure, is now in the Utilization State. Growth was foreseen during the planning phase. Modifications are taking place to accommodate new technologies, to improve existing ones, and to provide more Internet access points. The majority of planned LANs in the different buildings of UEM have been implemented and they are in use.

In general the procedures for the general information system, as implemented, are not in line with the Extended State Model. Utilization takes place while new functionalities are being introduced. The combination of the two states creates an opportunity for conflicts between users and the developers and creates lack of confidence on the part of users.

Many of the planned general information systems have not been acquired/developed because the lack of financial resources. Task forces created to plan such systems come to the end of their term before the results of their work can be implemented, which creates some frustrations.
7.7 Subjects and objects for assessment using the Three Kinds of MCM Model and the Expansion of the Three Kinds of MCM Model

7.7.1 Functional Management (FM)

Organization
Functional Management tasks at UEM are undertaken mainly by CIUEM, and by some faculties and administrative units. The university top management is also involved in some FM. The decentralization processes implemented within the university include the decentralization of ICT. For this reason the Functional Management is performed in university units owning ICT. Users perform Functional Management with support from CIUEM staff and ICT suppliers’ staff. Tasks related to FM are, however, not implemented fully.

Tasks
Table 7.7.1 provides an overview of the tasks undertaken by the different parties involved in FM tasks. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

<table>
<thead>
<tr>
<th>Task Areas/Task Fields</th>
<th>University Computer Centre (CIUEM)</th>
<th>Faculties and Administrative Units</th>
<th>External ICT Service Suppliers</th>
<th>ICT Consultants</th>
<th>University Top Management</th>
</tr>
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<tbody>
<tr>
<td>Strategic Management (SM)</td>
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<tr>
<td>Tactical Management (TM)</td>
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<td></td>
<td></td>
<td>✓</td>
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<tr>
<td>Technical Support (TSu)</td>
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Table 7.7.1 - Functional Management tasks undertaken by the different parties at UEM.
Processes
Processes related to FM are mainly undertaken by CIUEM. Such processes were presented in Section 7.3, where the entity MCM was presented.

Procedures
Procedures for the realization of tasks are occasionally formulated and written down. The implementation of procedures is ad hoc and they are not rigorously followed and controlled.

People
- Number: 150 people are involved in FM
- Education: 40% have a university degree and have followed some sort of management course. 10% have actually followed ICT courses.
- Experience: Most of the staff involved in FM have more than five years of working experience.
- Personnel turnover: University staff involved in FM often obtain new jobs and tend to leave the university.

7.7.2 Application Management (AM)

Organization
Application Management at UEM is undertaken mainly by CIUEM and faculties. ICT suppliers are also involved in AM. Application management is performed mainly by users but also by staff of software application suppliers, mainly from outside Mozambique. The units involved in the AM tasks are CIUEM, faculties and administrative units and ICT suppliers.

Tasks
Table 7.7.2 provides an overview of tasks undertaken by the different parties involved in AM tasks. The mark (v) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

Processes
Processes related to AM are mainly undertaken by CIUEM. Such processes were presented in Section 7.3, where the entity MCM was presented.

Procedures
Procedures for the realization of AM are normally not in written form. Where they are, they are not rigidly followed.

People
- Number: Around 300 people are involved in AM
- Education: 20% of staff involved in AM have a university degree. 80% of staff involved in AM have followed some sort of ICT course.
- Experience: Most of the staff involved in AM have more than five years of working experience.
- Personnel turnover: In general university staff involved in AM easily obtain paid jobs outside university and they tend to leave the university.
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<tr>
<th>Task Areas/Task Fields</th>
<th>University Computer Centre (CIUEM)</th>
<th>Faculties and Administrative Units</th>
<th>External ICT Service Suppliers</th>
<th>ICT Consultants</th>
<th>University Top Management</th>
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Table 7.7.2 - Application Management tasks undertaken by different parties at UEM

7.7.3 Technical Management (TM)

Organization
CIUEM and computer labs belonging to some faculties such as Engineering and Agronomy are involved in TM. Basic TM tasks are realized in the faculties, but complex TM tasks are performed by CIUEM. Hardware, software and communications suppliers are also involved in TM.

Tasks
Table 7.7.3 provides an overview of tasks undertaken by the different parties involved in common TM tasks. The mark (✔) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.
### Table 7.7.3 - Technical Management tasks undertaken by the different parties at UEM

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<th>Task Areas/Task Fields</th>
<th>University Computer Centre (CIUEM)</th>
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<th>External ICT Service Suppliers</th>
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**Processes**

Processes related to TM are mainly undertaken by CIUEM. Such processes were presented in Section 7.3 where the entity MCM was presented.

**Procedures**

Procedures for realization of TM tasks are not rigorously applied/realized.
People

Number: The university has 200 staff members involved in realization of TM tasks.

Education: 25% have university degrees. 6% have followed advanced ICT courses.

Experience: 40 university staff have over 5 years of working experience in TM.

Personnel turnover: Staff involved in TM are very volatile and staff turnover is very high.

Conclusions

Although are not recognized as such, the three kinds of MCM are realized in one way or another within the university. Processes and tasks to be performed under the Three Kinds of MCM are known, but are not totally followed because they are not fully understood. In all three kinds of MCM, CIUEM plays major role. Realization of tasks and processes is not formalized. They are performed on an ad-hoc basis. For the amount of ICT available in UEM there is a shortage of skills among staff involved in the three kinds of MCM. The few available skilled staff have acquired knowledge through short ICT courses. The qualified staff, however, often leave the university for better-paid jobs.

The education system in Mozambique does not offer ICT management courses in which skills in the different types of management can be developed.

7.8 Drawing conclusions for the Big ICT Five

For the overall assessment of UEM, we formulate the following conclusions in relation to ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization, and ICT service management:

Concerning ICT - Strategy

The University Eduardo Mondlane approved its first information policy plan (IPP) in 1992. The major players in the policy are CIUEM as far as the technical infrastructure is concerned, the faculties for dedicated applications, administrative units for administrative information systems and all university units for the office automation. In the IPP the university left out important strategic issues such as defining requirements and preconditions for ICT to provide full support for education and research, and paid more attention to requirements for ICT to support administrative services (which in their turn support education and research). It also paid great attention to the establishment of the university ICT common infrastructure such as EMUNet, but did not address other relevant strategic issues such as the cost of ICT services and skills development in the ICT area, which became a problem during the implementation of IPP. Since financial resources for ICT come mainly from donors, there has been little co-ordination of ICT acquisition for UEM. The 2001-2005 UEM ICT Strategy makes an attempt to improve the situation but no instruments have been put in place for its implementation. A strategy without clear implementation guidelines linked to available capacity cannot bring the desired value.

Concerning ICT - Acquisition/Development

UEM has a limited budget for the acquisition of common infrastructure such as fibre optic cabling for the main backbone and wireless technology. Involvement of CIUEM in deciding what to acquire and for what purpose is limited. It is therefore difficult to maintain standards across the university and this in turn strains the capacity of the limited human resources and makes it impossible to take advantage of bulk purchasing opportunities offered by ICT companies. UEM has not addressed important strategic issues such as in which circumstances an Information System has to be developed in-house or has to be acquired from software houses. This allows the few units with some knowledge and financial resources to start developing their own information systems which in many cases do not follow the States outlined in the State Model, bringing aggregation of States which weakens the capability of ICT to support the university. The benefits to be gained from common approaches to acquisitions are not widely recognized and accepted within the university. Given the dispersal
of acquisition and procurement functions and the difficulty of relating donor contributions to overall university requirements there is a need for a more systematic approach that would bring centralized and decentralized acquisitions within a single inventory.

Concerning ICT - Implementation
In general university units handle their own implementation with the involvement of vendors or suppliers. CIUEM is rarely involved and, when it is, it cannot always respond on time to requests from faculties because of lack of capacity and human resources. Project management procedures are not rigorously applied. This allows faculties and administrative units to start implementation of ICT without following relevant procedures that would produce good outcomes from ICT implementation within the university. ICT implementations do not consider strategic issues such as prior definition of service level agreements with ICT and ICT service suppliers, thereby weakening the ICT implementation. This makes it difficult to monitor the performance of the systems implemented and to ensure maximum benefit from scarce resources for systems support. In the absence of good system documentation, it can also complicate support and troubleshooting.

Concerning ICT - Utilization
The utilization of ICT is mainly PC-oriented, although multi-user systems are in place for administration of the academic processes, educational programmes and administrative processes. Each academic unit has a computer laboratory to serve students and academic staff. These are the areas of most concentrated ICT use. However, ICT utilization is not optimal: insufficient ICT and lack of knowledge prevent the academic, administrative staff and students from getting the best out of the available ICT. Since most of the ICT is acquired through donations within cooperation projects in which financial resources are made instantly available for capital investment, users become less informed about and/or less sensitive to the different components of costs involved in ICT. Strategic actions aimed at effective management of ICT infrastructure and of the flow of users could expand the ICT user population within UEM. These and other strategic issues such as understanding the ICT in/for use, know-how on ICT security in a university environment and more realistic assessments of training needs and costs, need to be properly addressed.

Concerning ICT - Service Management
ICT service management is mainly centralized at CIUEM, although some faculties such as Engineering and Agronomy attempt to support their own ICT up to certain level. There are no formalized procedures between CIUEM and faculties and administrative units for support to the utilization of ICT. Service management could be improved if responsibilities were more clearly defined and understood throughout the university. SLAs should have a meaning and play a role within UEM. CIUEM's basic service menu was defined at a time when it was almost the sole provider in Maputo and in Mozambique. To ensure that CIUEM is complimentary and not competitive in the services that it provides on campus, strategic issues need to be addressed, including service delivery, user groups' relationships, management of ICT cost components, and realization of management tasks at appropriate levels, following defined procedures with periodic reviews.
Information about UNAM was obtained from UNAM annual reports, strategic plan, other publications, www.unam.na and field assessment, and was verified by the Director of the Computer Centre.
8. ASSESSING THE UNIVERSITY OF NAMIBIA (UNAM) – NAMIBIA

Introduction
The objective is to assess the Big ICT Five in the University of Namibia (UNAM) by applying the models presented in Chapter 4. For the assessment we will follow the outline presented in Section 4.3 of Chapter 4.

8.1 Subjects and objects for assessment of the entity Real System using the MCM paradigm

In relation to the entity Real System, we focus on following subjects and objects:
- Historical background
- Location
- Organization
- Services
- Administration supporting education, research, and services
- People
- Situational Factors

Historical background
Before independence, educational planning for Namibia was controlled from South Africa. In 1980, the first higher education (HE) institutions were established in the country in the form of an Academy comprising the Technicon and the College for Out of School Training. These institutions were affiliated to UNISA in South Africa until 1985, when the Academy Act (Act 9 of 1985) granted autonomy to the existing institutions of higher education in the country, and added a third component: the University of Namibia.

The University of Namibia granted its own degrees, diplomas and certificates for the first time in 1987. Following independence, a Presidential Commission was established to examine the HE sector. The Commission submitted its report in September 1991 and recommended that the Academy be dissolved and a new national University (UNAM) and a Polytechnic of Namibia be established. A designated Vice-Chancellor and a Transitional Planning Team had the task of initiating the planning and development of the new university. At the same time, a joint Technical Committee of Cabinet on HE; comprising personnel from the office of the designated Vice-Chancellor and Ministry of Education and Culture, was established to study and evaluate the various recommendations of the Presidential Commission. In 1991 the Cabinet adopted the recommendations of the Commission. On August 4th 1992, the University of Namibia Act (Act 18/1992) was promulgated by the National Assembly and it became operative on August 31st 1992.

Location
The University has three main sites: at Windhoek, the capital; at Neudamm, 40 km from Windhoek; and the Northern Campus at Oshakati, 730 km from Windhoek. It also runs the Henties Bay Marine and Coastal Research Centre.

Organization
Organizational Structure. The organizational structure of UNAM can be fitted into the Mintzberg logo as illustrated in Figure 8.1.1.

Education and Research. Education and research activities are undertaken within faculties/departments and research centres and institutes. For education and research in the area of ICT, the Faculty of Science has a Department of Computing and a Department of Engineering.
Chapter 8 – Assessing the University of Namibia (UNAM) - Namibia

Figure 8.1.1 – The Mintzberg Logo applied to UNAM

The Computing Department offers computer science courses through a four-year B.Sc. degree programme; the Master's degree requires two more years of study. Most of the university courses include some computing disciplines in their curricula. A course on media studies and information technology is also offered. None of the courses offered by UNAM provides ICT management skills. Research undertaken by the university has so far been aimed at supporting the teaching and learning activities. The academic and non-academic staff directly involved in teaching and learning, research and extension services is attached to the faculties and centres identified in Table 8.1.1.

<table>
<thead>
<tr>
<th>Faculties (F1 – F7), Centres and Units</th>
<th>Courses/Departments</th>
<th>Staff</th>
<th>Student population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Academic</td>
<td>Non-Academic &amp; Administrative</td>
</tr>
</tbody>
</table>
| F1. Faculty of Agriculture and Natural Resources | Agricultural Economics and Extension  
Animal Science  
Crop Science  
Food Science and Technology  
Natural Resources and Conservation | 32 | 15 | 164 |
| F2. Faculty of Economics and Management Science | Accounting, Auditing and Income Tax  
Economics  
Management Science  
Political and Administrative Studies  
Centre for Public Service Training (CPST) | 44 | 4 | 888 |
| F3. Faculty of Education | Educational Psychology & Special Education  
Educational Foundations and Management  
Human Movement Studies  
Mathematics and Science  
Curriculum Instruction & Assessment Studies Media Laboratory  
Adult & Non formal Education | 54 | 5 | 673 |

Table 8.1.1 – Academic, non-academic and student population breakdown by units and courses offered by UNAM, 2000
### Faculties (F1 – F7), Centres and Units

<table>
<thead>
<tr>
<th>Courses/Departments</th>
<th>Staff</th>
<th>Student population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Academic &amp; Administrative</td>
<td></td>
</tr>
<tr>
<td>F4. Faculty of Humanities and Social Science</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- African Languages</td>
<td>80</td>
<td>507</td>
</tr>
<tr>
<td>- English</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Geography and Environmental Studies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Germanic and Romance Languages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- History Department</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Information and Communication Studies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Performing Arts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Visual Arts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Psychology and Special Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Religion and Theology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Social Work and Community Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sociology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Ecumenical Institute of Namibia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F5. Faculty of Law</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Public Law and Jurisprudence</td>
<td>42</td>
<td>150</td>
</tr>
<tr>
<td>- Private and Procedural Law</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Commercial Law</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Justice Training Centre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Human Rights Documentation Centre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Centre for Applied Social Sciences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F6. Faculty of Medical and Health Sciences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Nursing Science</td>
<td>52</td>
<td>772</td>
</tr>
<tr>
<td>- Paramedical Studies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Scientific Foundation of Nurse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F7. Faculty of Science</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Biology</td>
<td>84</td>
<td>472</td>
</tr>
<tr>
<td>- Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Computing</td>
<td></td>
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<tr>
<td>- Engineering and Technology</td>
<td></td>
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</tr>
<tr>
<td>- Geology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Physics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pure and Applied Mathematics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information &amp; Learning Resource Centre (ILRC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Windhoek Campus</td>
<td>19</td>
<td>31</td>
</tr>
<tr>
<td>- Faculty of Agriculture &amp; Natural Resources (NEUDAMM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Faculty of Agriculture &amp; Natural Resources (OGONGO)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Northern Campus (GSHAKATI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Computer Centre (CC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centre for External Studies (CES)</td>
<td>77</td>
<td>1522</td>
</tr>
<tr>
<td>Language Centre (LC)</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>Multi Disciplinary Research and Consultancy Centre (MDRCC)</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Administrative Units (Registry, Bursary, Maintenance and other units)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>521</td>
<td>355</td>
</tr>
</tbody>
</table>

Table 8.1.1 (cont.) – Academic, non-academic and student population breakdown by units and courses offered by UNAM, 2000

The major activities being undertaken by the university in order to reform its educational, research and management systems are the design of the University Strategic Plan, the design of the University ICT Policy, the staff development programme, the establishment of the Information and Learning Research Centre (ILRC), and the upgrade of the university technical infrastructures.
At the time of our assessment, the strategic plan had been developed and was being implemented. It was too soon to have any sense of its impact. The ILRC is now functional and it is now possible to sense the positive impact of the services provided by the university to students and the academic community. The ICT policy, however, is still in the design phase. We were given access to the main suggested outline, but it was pointed out that this might be changed before the final document is approved.

**Services**
Apart from its main mission of education and research, the university also has a number of services that directly or indirectly support the main mission of the university. Such services include:

**Transport.** The university provides transportation services to the students, academic and administrative staff by allocating buses that are run by a university administrative unit.

**Library.** The ILRC includes central library services, which host many titles that can be accessed manually and electronically. The library also serves as an instructional design unit, provides interactive multimedia services and books, international publications and journals for distribution in the campus, and Internet access for students.

**Security.** The university has a security unit (Internal Protection and Security Unit), which is mainly responsible for safeguarding the UNAM assets. In its duties, this unit is supported by services hired from outside the university.

**Social Services.** The university runs social services for students such as student accommodation, provision of food for students.

**Housing.** The university manages housing facilities for academic and administrative staff.

**ICT.** The university has a Computer Centre (CC), which provides ICT services to the university.

**Administration supporting education, research, and services**
The organisational chart of UNAM's administrative and managerial structure (the Officers of the University (Vice-Chancellor and two Pro-Vice Chancellors), University Council, Academic Council and the Council of Directors) is presented in Figure 8.1.2.

The Vice-Chancellor is the main authority within the university and is responsible for the administration of the whole university. In his duties he is assisted by two Pro-Vice Chancellors. One is responsible for the coordination of academic affairs (the Pro-Vice chancellor for Academic Affairs & Resources) and the other for the coordination of administrative issues (the Pro-Vice Chancellor for Administration and Finances).

The Pro-Vice Chancellor for Academic Affairs coordinates the deans of the seven faculties, the Director of the Northern Campus, the Director of the Centre for External Studies, the Director of the Language Centre, and the Director of the Multi-disciplinary Research & Consultancy Centre. On a daily basis the following units also report to him: the Registrar, the Director of Strategic Planning, the Director of Information Programme & Liaison, and the Director of Communication and Marketing.

The Pro-Vice Chancellor for Administration and Finances coordinates the Bursar, the Director of Estate Services, the Physical Planner, the Director of Human Resources, the Manager of the Computer Centre, the university Library, and the Dean of Students. The Administration and Finance area provides support to and administration of the university patrimony, its acquisition, distribution and allocation, and takes care of safeguarding of the university assets, including their regular inventory. The acquisition of hardware and software is formalized within the norms and procedures for general acquisitions in the university. There is no specific procedure for ICT acquisition, which is a disadvantage for the university.
The role of the acquisition committee does not prevent units with funds from acquiring whatever they want. In some cases, the ICT acquired is unacceptable as it cannot be used by the user groups, and the university is forced to re-negotiate the items acquired and their replacement by more appropriate ICT.

The Bursar centralizes the administration of the university's finances and provides support to the whole university on matters of financial administration.

The Physical Planning Office centralizes the administration of new construction and the maintenance of the university's physical infrastructures.

Even without an ICT strategy, UNAM continues to make substantial investments in the acquisition and implementation of ICT. Nevertheless, UNAM is seeking an ICT strategy that can answer the question: How can ICT be used to support the university's main mission of education and research, in line with the expectations that Namibia holds for the university? Clearly there are risks that could be minimized by implementing the ICT within an approved framework and common vision. At the time of our research the impact of the UNAM strategy plan could be felt mainly in the decision to create the ILRC, as this provides leadership within the university for the implementation of approved documents. Although this is a positive achievement, in general the implementation of the strategic plan has been compromised by lack of skills and lack of financial resources. However, these two constraints are part of the
Real System that needs to be acknowledged and dealt with in the ICT strategy design process. It is of less value to have a perfect plan than to have a plan that can be implemented.

The daily administrative activities are being stimulated by the establishment of new reforms aiming to equip the administration of the university with new and modern management tools that will allow it to support better the main mission of the university. As part of the ongoing processes under the UNAM strategic plan, a huge computer network has been established, as well as the ILRC, which has been granted the status of national library and research centre. The design of the university ICT strategy is still underway as are reforms in the staff development programme. In Figure 8.1.3 we outline the three major ongoing processes, covered by individual documents in which the major directions of the university are given, namely the university strategic plan, the outline of the ICT strategy and as a consequence of these, the reforms being undertaken within the university to enable better implementation of UNAM’s strategic plan.

People
Academic staff, non-academic staff and students of UNAM form the UNAM population. The university population can be expressed as follows:

**Numbers.** 521 academic staff and 355 technical and administrative staff are involved in education and research. UNAM has 5148 students.

**Education.** 100% of the academic staff have followed higher education.

**Experience.** Most academic staff have more than five years of working experience. A substantial number of the academic staff are not Namibian citizens and most of these have a PhD degree.

**Personnel Turnover.** The personnel turnover is very high. Most of the university staff who have oversees training have other paid jobs, which do not allow them to devote all their time to the university.

Situational Factors

**Specific situational factors.** Culture of the UNAM, and Starting point for ICT.

**Culture.** According to the UNAM website: “A unique confluence binds the birth of the new nation with that of the university. Both are repositories of democratic values. UNAM constitutes a vital part of a vibrant civil society. As such it renders democracy more meaningful, particularly by upholding both the cardinal value and the practice of academic freedom. This in turn enables the institution to initiate and shape open discourse on all aspects of Namibian society. Through its emphasis on relevant teaching and applied and participatory research, UNAM cultivates humane values and environmental awareness. Inspired by these values, the university stands ready to serve the nation.

“UNAM’s mandate requires that the institution should play a pivotal role in influencing the society’s attitudinal transformation from the racial bigotry of the pre-independence period to genuine reconciliation. UNAM has already introduced programs to assert its commitment to the national policy on affirmative action whereby victims of past discriminatory practices are given priority. Consequently, formerly disadvantaged students are afforded opportunities to upgrade their language, science and mathematics skills and knowledge through bridging programmes” (source: www.unam.na).

Major decisions of UNAM are based on recommendations of committees set up for different tasks. In practice, most of the committees have the same people and the committees are generally very slow in producing recommendations for decisions.

**Starting point for ICT.** UNAM is a relatively new university; it was only established in 1992. The forerunners of UNAM did not specialise in technology and the use of ICT is recent. Although computer science subjects were part of courses such as engineering, the computer science course was established only in 1998. This gave UNAM the opportunity to start with relatively advanced ICT. To date, the university has kept pace with the changes in technologies and ICT is spread throughout the campus.
Chapter 8 – Assessing the University of Namibia (UNAM) - Namibia

Strategic Objectives

1. Access and Outreach
   1.1 Entry to the University
   1.2 Increasing opportunities for formerly disadvantaged Namibian to obtain educational and other University services through outreach and close community involvement
   1.3 Improving open and distance learning services throughout Namibia, by Investment in facilities

2. Relevance and Applicability
   2.1 Increasing the relevance of academic programmes, in order to ensure that they meet the needs of the employers, they cater for self-employment, and prepare students for life-long learning
   2.2 Developing new programmes (undergraduate and postgraduate) in relation to the expressed needs of relevant stakeholders and communities
   2.3 Student and learning environment
   3.1 Improve student learning, through enhancing lectures teaching and students learning capabilities
   3.2 Establish effective counseling and support structures and procedures in order to promote HIV/AIDS awareness and minimize the impact of this epidemic
   3.3 Strengthening student support services, by providing and enabling social and cultural environment and facilitating the provision of financial assistance
   3.4 Expanding, strengthening and enhancing the efficient utilization of learning resources and facilities: the library, computer center, laboratories
   4. Affirmative Action and Staff development
   4.1 Strengthening Staff Development for all staff and implementation of the affirmative Action Act, thus promoting local capacity building and employment equity
   5. Basic and Applied Research
   5.1 Expanding and strengthening applied research and consultancy services relevant to the socio-economic development of the country
   5.2 Promoting the development and application of science and appropriate technology in the country
   6. Cost Effectiveness and Income Diversification
   6.1 Increasing the cost effectiveness of the University, through focused expansion, cost containment and enhance efficiency
   6.2 Adopt a medium-term perspective in the annual financial budgeting, taking into consideration the priorities set in this five year Development Plan
   6.3 Diversifying sources of financing, by increasing private income through fund raising and the provision of marketable services
   7. Common Values
   7.1 Improving the corporate governance of the University
   7.2 Improving the management of the University

1. Strategic Relevance
   1.1 Focus on 5 year plan
   1.2 Link to overall University Planning
   2. Tactical Level ICT Management
   2.1 Long term goals
   2.2 Short term goals
   2.3 Individual project goals
   2.4 Resource required (strategy for how to get them)
   2.5 Efficiency of acquisition, installation, maintenance and use
   2.6 Coordination of ICT policy
   3.1 Establish clear organizational arrangements for use
   3.2 Top management’s role in development and updating
   3.3 Role of ICT professionals and users – understanding limitations
   4. ICT professionals’ responsibilities
   4.1 Develop procedures that ensure that, for potential ICT projects, a comparison is made on internal development versus purchase
   4.2 Develop the a set of standards that establish:
   4.3.1 Mandatory communication standards
   4.3.2 Documentation procedures
   4.3.3 Data dictionary
   4.3.4 Operating System
   4.4 Identify and provide appropriate ICT management Staff career paths
   4.5 Prepare detailed check lists of questions to be answered in any hardware/software acquisition to ensure that relevant technical and managerial issues are raised
   4.6 Identify and maintain relationships with suppliers
   4.7 Establish education programmes for (potential) users that communicate both the potential and the pitfalls of modern ICT and that define the users’ roles in ensuring its successful introduction
   4.8 Establish an ongoing assessment/review of ICT services and systems for determining which ones are obsolete and should be replaced/redesigned
   5. Users Responsibilities
   5.1 To assist in the orderly implementation of ICT services and in order to understand their use, post, and impact on the institutions, the following responsibilities should be fulfilled by the (potential) users of ICT services:
   5.1.1 Clearly understanding the scope of all ICT services supporting the user
   5.1.2 Rationally appraise the amount of user personnel investment that will be required for each new project
   5.1.3 Ensure that comprehensive user input takes place for all ICT Projects
   5.1.4 Periodically audit the adequacy of systems, system standards, performance, and adequacy of security procedures
   6. Role of Senior Management
   6.1 ICT Policy implementation not possible without top management support
   6.2 Driven by need, and encouraged by realization of 5 year development plan
   6.3 Lack of commitment is a great risk to efficacy of ICT Policy development and implementation

Figure 8.1.3 - Ongoing processes at UNAM

- Design of the University Strategic Plan (five years)
- Design of the University IT Policy
- Staff development (Capacity Building Policy)
- Upgrade of the University Ethernet Network
- Upgrade of the Internet Pipe (E-mail, Web Browsing)
- Connecting all satellite Centres to the internet
- Change of the KYPLEX System to Northal System
- uRC to become national Library

<table>
<thead>
<tr>
<th>Univ</th>
<th>Gov.</th>
</tr>
</thead>
</table>

142
Generic situational factors. Relationships with ICT suppliers and discontinuity of management

Relationships with ICT suppliers. Some relationships with suppliers are governed by formal agreements. However, UNAM is not able to enforce these agreements, and suppliers often do not fulfill their obligations. More generally, relationships with ICT suppliers are on an ad hoc basis and are very weak.

Discontinuity of management. Deans rotate every two to three years. Discontinuity is not disruptive.

Conclusions
The education and research at UNAM also covers the education and research in the area of ICT. As part of the ongoing internal reforms the university is designing its ICT Strategic Plan. In the design process, the issues being considered are related to the strategic relevance of ICT to the education and research, promotion of the national economy through use and application of ICT, coordination of ICT policy, the responsibilities of ICT professionals, user responsibilities, the role of the Computer Centre and of the top university management, and the review of the ICT strategies of some partner universities. Whilst planning is progressing slowly, UNAM is purchasing a substantial amount of ICT.

8.2 Subjects and objects for assessment of the entity ICT using the MCM paradigm

In relation to the entity ICT, we focus on the following subjects and objects:

- Complexity factors.
- Hardware/Software/Communication characteristics
- Data set characteristics
- Procedures' characteristics

Complexity factors
Quantity. 928 PCs, a number of communication facilities, 3 operating systems and 12 application software packages are available. ICT within UNAM is growing, as new computer labs and Internet connection points are established.

Diversity. UNAM has various types of ICT components from different manufacturers and origins, forcing the university to have relationships with the suppliers of all these types of ICT components. ICT suppliers are mainly based in South Africa.

Distribution. UNAM has its ICT dispersed throughout its different locations.

Dynamics. Changes in hardware and software take place rapidly at UNAM. The staff of CC, faculty staff members and staff of ICT suppliers introduce changes in hardware and software. Changes are not controlled. They are made on an ad hoc basis.

Functionality. ICT is employed for different functions within UNAM.

Relationships. The existing ICT is networked, but the administrative systems have not been linked to the network.

Ownership. The university owns the ICT. The Vice Chancellor has delegated some responsibilities to the heads of Academic and Administrative units. The delegation of responsibilities also includes responsibilities for ICT allocated to them.

Utilization. The users in each academic or administrative unit utilize the ICT available. There is, however, a difference in access and utilization by academic staff and students and the administrative staff. The first two use the available ICT in a free form for specific individual needs. The administrative staff are tied to more specific tasks and it is here where ICT is applied. For example, the Bursar's staff can only use ICT in the form of the Finance Management Information System.

Sophistication. The university ICT is very advanced, especially the ICT available at ILRC. Most of the university staff have insufficient knowledge and understanding of the sophisticated ICT available, which makes it difficult for them to use and/or service it properly.
Chapter 8 – Assessing the University of Namibia (UNAM) - Namibia

<table>
<thead>
<tr>
<th>Type</th>
<th>Topology</th>
<th>Capacity</th>
<th>Beneficiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Backbone</td>
<td>10 Base T</td>
<td>Star</td>
<td>155mbs</td>
</tr>
<tr>
<td>Local Area Networks</td>
<td>10 Base T</td>
<td>Star</td>
<td>155mbs/Ethernet</td>
</tr>
<tr>
<td>Wide Area Network</td>
<td>Leased Line (Telecom Namibia)</td>
<td>Star</td>
<td>64kb Fibber Optic</td>
</tr>
<tr>
<td>Internet</td>
<td>10 Base T</td>
<td>Star</td>
<td>155mbs/Ethernet</td>
</tr>
</tbody>
</table>

Table 8.2.1 - Networking infrastructure of UNAM

To illustrate the complexity of ICT we refer to Figure 8.2.1, which shows the variety/diversity in communication facilities and their capacity.

Hardware/Software/Communication characteristics, such as:

Network capacity. The ICT at the main campus consists of a star topology with a mail server, which is UNIX based, and a server for the shared applications as indicated. The network is an Asynchronous Transfer Mode (ATM) network, running Ethernet (10 Mbps) from the hubs to the workstations dispersed over the buildings of the campus. The ICT of each building is connected with concentrated computing facilities by Ethernet cable (category five). The main campus is linked to decentralised facilities via leased lines from the Namibia telecom. UNAM obtains its Internet connection locally. The university has implemented the African Virtual University programme. This programme allows, among others, features such as access to electronically-communicated, up-to-date lectures.

Standardization. Standardization has not been planned.

Quality of technical facilities. The technical facilities are of high quality, up to date with last market releases and versions.

Data set characteristics, such as:

Extent. The existing databases are of small size – a few hundred megabytes for each of the following: the Finances Information System, Student Records Information System and Payroll and Personnel Information System.

Standardization. There is little standardization of databases.

Database management Software. Oracle and Access database management software are used within UNAM.

Procedures’ characteristics, such as:

Number. The total number of procedures is not known. Some users do not give due importance to existing procedures.

Extent. Procedures are based on practices. Few are in written form.

User friendliness. The existing written procedures are very descriptive. The entities issuing such procedures cannot determine how user friendly these are.

Language. The existing procedures are mainly written in English, the official language. Technical documentation is written in English.

Conclusions

UNAM has an extensive ICT infrastructure and a huge number of components. The available ICT is of several types and from different manufacturers and origins. A good understanding of this highly complex ICT infrastructure is required. So are well-defined user groups. UNAM also needs professional ICT service management to support the implementation and utilization of its ICT in accordance with requirements, pre-conditions and situational factors, so that it may contribute positively to the university’s core business.
Chapter 8 – Assessing the University of Namibia (UNAM) - Namibia

Figure 8.2.1 - University of Namibia ICT Infrastructure
8.3 Subjects and objects for assessment of the entity MCM using the MCM paradigm

In relation to the entity MCM, we focus on the following subjects and objects:
- Organization
- Tasks with reference to tasks areas and task fields
- Processes
- Procedures
- People

Organization
The Management, Control and Maintenance (MCM) of the ICT supporting the university are centralized in the University Computer Centre (CC) but mainly entrusted to external ICT service suppliers. Some MCM activities are also undertaken by certain faculties, such as the Faculty of Engineering, and by external ICT services, such as the national PTO, the Public Electricity Company and the national Internet supplier.

The CC operates as an ICT service unit for the entire university. UNAM’s major objective for the CC, as stated in the ICT strategy, is to support UNAM as a whole in the processes of ICT planning, deployment, training, management and maintenance. In this regard, CC provides:
- advice and support to UNAM units during ICT planning and development stages;
- procurement and installation of ICT hardware and software;
- technical ICT implementation, maintenance and support services;
- user training.

Within UNAM, these activities are undertaken through specialized units and staff as indicated in Figures 8.3.1 a) and b)

![Diagram of UNAM Computer Centre: current organization chart, 2001](image)

In the current organizational structure of the Computer Centre, eight (8) staff members are available and carry out the following functions:

**Help Desk.** With two staff members, it serves as liaison office between the computer centre and the rest of the university units. The help desk logs all inquiries and incidents reported to the computer centre by users and directs them to the top management or technical staff.

**Software Support & Statistics.** With one staff member, it provides data entry on statistical applications and support for software application for academic and administrative staff.

**Infrastructure/Technical Support.** With two staff members, it provides a first line of support and undertakes some hardware maintenance and repair when users from university units make requests.
Chapter 8 – Assessing the University of Namibia (UNAM) - Namibia

**Instructional Technology & Networking.** With two staff members, it provides ICT training and the first line of support to the network facility of UNAM. The Computer Centre is run by a manager who has the status of director or head of department in the university management scheme. He is not involved in operational technical activities on a daily basis but he is responsible for the overall management of the Centre.

It is proposed that the Computer Centre be reorganized, as shown in Figure 8.3.1 b). This reorganization is expected to be approved jointly with the University ICT Strategy.

![Diagram of Computer Centre Organization](image)

**Figure 8.3.1 b) - UNAM Computer Centre: proposed organization chart, possibly to be approved with the ICT strategy**

**Tasks**
According to the summary of the MCM paradigm and the Three Kinds of MCM/Expansion models presented in Chapter 4, management tasks can be found and performed within MCM entity of MCM paradigm and within the three kinds of MCM, forming Functional Management (FM), Application Management (AM), Technical Management (TM). In the entity MCM, such tasks are realized in more than one organization. Within UNAM, the CC, with a certain level of organization and some experience, performs most of the TM. AM and FM are weakly performed. Section 8.7 will explore in more detail all tasks and the organizations performing them by using the model Three Kinds of MCM.

**Processes**

**Incident Management.** Incidents are logged into the existing Help Desk. The Help Desk is located at the CC. As soon as incidents are logged to the Help Desk, a technical CC staff member is assigned the task of visiting the unit/user that reports the incident. First-line support is given. When the incident cannot be managed by CC's technical staff, ICT suppliers are called in for in-depth investigations and restoration of services. The response time is relatively rapid (within a few hours). In general, most of the incidents reported are cleared. The solutions provided are not always recorded.

**Problem Management.** The staff of ICT suppliers perform some form of problem management. In general problems are solved, but without going to the root cause of
the problem, as a result of which the problem often recurs some time after repair. Thus problems are not managed professionally.

Change Management. Whenever new ICT is acquired, some form of change management takes place as a consequence. CC staff, faculty staff members and ICT suppliers perform some change management on an ad hoc basis. Change management is not formalized.

Configuration Management. Occasionally configuration management for hardware and software takes place. In general, the CC, faculties or administrative units undertake ICT acquisition independently. Sometimes however these units acquire ICT through the CC. Sometimes donations are made directly to the CC or to other units within the university. This makes it difficult to maintain a university-wide inventory of ICT. After ICT is acquired or donated, the acquisitions/purchasing officer labels it and it delivered to the university unit concerned.

Release Management. No release management takes place

SLA Management. Service Level Agreement management is very weak. SLAs centrally signed with ICT suppliers are not formalized in agreements with UNAM units. The perception of the users within the university is that the computer centre should serve them when needed. There is no SLA between the CC and other university units. This leaves room for accusations of lack of performance by the parties involved.

Capacity Management. No capacity management takes place.

Contingency Management. No contingency management is done.

Availability Management. UNAM with its large ICT infrastructure is now concerned about whether and how a disaster recovery programme could be implemented.

Cost Management. Some sort of cost management is done.

Network Services Management. Network service management is performed by the CC and ICT service suppliers.

Procedures in written form
Most of procedures on the realization of MCM tasks are expressed orally. A limited number of procedures performed by the CC and by external ICT service suppliers are in written form in English, the official language. The support documentation consists mainly of the technical and user manuals/documentation supplied together with hardware and software and written in English.

People

Number. Around 20 people from the CC, the faculties and external ICT suppliers realize MCM tasks in one way or another.

Education. Around 10% of staff realizing MCM tasks have some understanding of them, the majority of whom are from the CC.

Experience. Around 10% of staff dealing with MCM tasks have many years of working experience in their field of ICT operation. This number is insufficient to handle all the required service management professionally.

Personnel Turnover. University staff with MCM skills can easily get well-paid jobs outside the university. With the exception of the ten most experienced CC staff, staff generally leave the university as soon as they have acquired enough experience and have completed a certain number of ICT courses.

Conclusions
The MCM at UNAM is centralized at the CC and external ICT suppliers, so both play an important role in the realization of MCM tasks. Some faculties also perform some MCM tasks. Not all MCM processes are covered. The ones that are performed are often not performed at an appropriate level. SLAs are not always formalized, and the formalized SLAs with ICT suppliers are not fully known to the users and few procedures are in written form. Most of them are stated orally. MCM tasks are executed on an ad-hoc basis and ICT service
management still leaves out many MCM tasks that need to be carried out systematically in a professional way in order to provide a positive contribution to the university.

8.4 Subjects and objects for assessment of internal relationships using the MCM paradigm

In relation to the internal relationship, we focus on the following subjects and objects for assessment:

Relation RS → ICT. Requirements and preconditions
The university exploits a student management information system, a payroll and human resources information system, a finance information system, and distance education for its own benefit. The university also exploits UNAM Net for its benefit. Requirements and preconditions for these ICT have been formulated. The lack of skilled users and training programmes to improve skills prevents the university from getting the best out of its ICT.

Relation RS ← ICT. Way of support
The university is supported in its activities in relation to students, staff, finances and education and research by the Student Records Information System, the Payroll and Personnel Information System, the Finance Information System, distance education, and the UNAM Net. Extracting information generated by the ICT on time is not always possible because of the limited number of qualified users.

Relation ICT → MCM. Kind of data to support MCM
The technical staff of the CC and ICT service suppliers are supported by the data from the Student Records Information System, the Payroll and Personnel Information System, the Finance Information System, the distance education, and the UNAM Net. The degree of sophistication of the ICT and the lack of skills in users does not always allow proper interpretation of the data generated.

Relation ICT ← MCM. Way of management
Technical staff at the CC and staff from suppliers provide support to the available ICT in collaboration with the user departments of the Student Records Information System, the Payroll and Personnel Information System, the Finance Information System, the distance Education and UNAM Net. Because many AM and TM tasks are not carried out and the available data are sometimes interpreted wrongly, situations can arise in which decisions are not supported by the data provided.

Relation RS → MCM. Requirements and preconditions
The university employs the CC technical staff to manage the Student Records Information System, the Payroll and Personnel Information System, the Finance Information System, the distance education, and UNAM Net. In this relationship the university has not established detailed SLAs stating requirements and preconditions as indicated in the ICT strategy to be fulfilled by the CC. The CC is understaffed and its positioning within the university has not been clearly established, with adverse consequences.

Relation RS ← MCM. Way of support
Technical staff members of the CC respond to users’ requests within the university, as part of their duties as employees of the university. There are no formalized SLAs governing such requests. This makes it difficult for the CC to operate professionally.

Conclusions
The university has formulated requirements and preconditions for the existing ICT. Areas covered by ICT support are clearly defined. Lack of skilled users prevents proper utilization of ICT and the university is unable to exploit its full potential.
The lack of qualified people able to understand the sophisticated ICT also prevents units performing MCM tasks related to application management and technical management from taking timely decisions based on the data generated by the ICT. This creates weaknesses in the ICT service management.

Requests for ICT services made to the CC are handled on an ad hoc basis. Formal Service Level Agreements have not been established. These should cover strategic issues such as ICT services to be offered/done; quality levels and costs of such services; and management of relationships between the university and ICT service suppliers. Given the large amount of ICT available within the university, UNAM sees the need for a fully professional university ICT service with a clear role and position within the university, and with adequate resources to provide immediate support to UNAM's education and research programmes.

8.5 Subjects and objects for assessment of the external influences using the MCM paradigm

Economy
On a scale of -1 to +1 on the African Competitiveness Index 2000 designed by the Centre for International Development at Harvard [ACR2000], Namibia is rated as +0.4 (for comparison, Tunisia is +1 and Madagascar is -0.6). Namibia's population is 1.742 million. Its real GDP per capita was USD 3,546.00 in 1998, having grown at a rate of 3.3% per annum between 1990 and 1999 [ACR2000]. Due to the reluctance of the minority-controlled private sector to invest locally, the government is promoting foreign investment by establishing a policy and legislative framework favourable to investment. This also creates a good environment for the development of a local ICT industry.

Education
Namibia's education system is influenced by South Africa and Germany. Namibia is striving to establish its own education system, as this will benefit the majority of its indigenous population. According to the World Development Report 2000/2001, in 1997, public expenditure on education was equivalent to 9.1% of the GNP [World Bank2000].

The low level of ICT skills and literacy in Namibia affects the recruitment and retention of skilled users and trained technicians by the University of Namibia. The few who are trained can easily get better-paid work outside the university. The university - which should be a leader in ICT within the country - finds it difficult to provide quality service and to support and train its own staff and students. However, Namibia has recently introduced a fast growing School Networking programme, which should expand the supply of ICT-literate graduates.

Governance
The Chancellor of the University is the President of Namibia. The Vice-Chancellor, as the day-to-day manager of the university, reports to the chancellor. This link allows prompt intervention by the President of Namibia when needed. The collegial entities of the university - the University Council and the Senate - provide administrative policies and academic direction for the long- and medium-term objectives defined for the university, respectively. The relation between the university and other government units such as the Ministry of Finance and the Ministry of Education is there for the purpose of coordination, not management. Nevertheless, the political connection leaves the university open to pressures external to its own needs.

Donors
In its annual report of 2000, UNAM states "a significant amount of money was raised by UNAM from various donors. Indeed, the University of Namibia has been very successful over the years to obtain significant amount of funding from sources other than the Government." [UNAM2000] Major donors include UNESCO, World Bank, UNDP, Finland, just to mention a few. These donors finance most of the ICT projects. The efforts of the donors complement the financial resources provided by the government. Procedures for ICT acquisition differ
according to the source of funding. As a consequence, management and support of acquisition of the different ICT is complex and it is difficult to maintain a university-wide inventory. This problem will continue since donors are expected to provide more financial resources for ICT projects.

Technology and Suppliers of Technology

Namibia, for colonial and geographical reasons, is influenced by South Africa in all areas including ICT. For instance, although major hardware brands can be found in Namibia, there are vendors/suppliers that fly in and out of Namibia on the same day. Most vendors are dealers and sell limited but expensive after-sales services. The guarantees offered by the fly-in dealers often expire before their suppliers manage to get the hardware and software to the end users. Dependence on South Africa makes it difficult to ensure speedy response to technical problems.

The public sector, to which the University belongs, has no ICT policy to provide a framework for university policy. The Telecom company has a monopoly position. As it has no need to compete, it introduces technological change very slowly, although it has already introduced some digitised circuits in the country. It still runs analogue circuits to public subscribers, while most of the private sector already uses a digital infrastructure on their premises. The university has decided to establish its own international AVU link to bring distance education and the Internet to the university community. It relies on a 64 Kbits connection to South Africa for the Internet.

The Telecom monopoly limits the university’s access to new technical options to support decentralised networks. With the approval of the national ICT policy by the government of Namibia, the university has a guiding framework within which to define its broader responsibilities to use ICT to promote a Namibian knowledge society.

Conclusion

UNAM is governed by civil service rules and is influenced on a daily basis by the government. Its close relationship with the government means that decisions are not always within the purview of university governance; they have a political dimension and can also be delayed by bureaucratic processes, which influences the implementation of the university strategy negatively.

Donors contribute greatly to finance ICT programmes, but in many cases they pressure national institutions to reshape the programmes these institutions identify as important to fit their own agendas. ICT acquisition, for example, is very much influenced by the interests of the donor countries or organizations. This has a negative impact on the implementation of most ICT projects because important factors such as sustainability and skills building are not taken into account. Some donors organize frequent ICT promotional activities in different and distant parts of the world, which have little impact on national activities. The promotional activities of donors can draw resources away from national ICT objectives and disperse the small concentration of skilled staff. This causes delays in ICT implementations and also results in the few skilled staff having less time to provide professional ICT services to support the university.

Major brand names of European, American and Asian hardware, software and communication technologies can be found in Namibia, and so there is a high diversity of ICT, which is distributed throughout the country. This imposes on Namibia the need to invest in and encourage the establishment of professional ICT service management in the country. The government of Namibia has recently designed and approved the National Information Policy and the ICT strategy. The policy and strategy will guide the ongoing ICT activities and those to come. It is expected that it will also cater the development of a national ICT industry alongside with the development of education and research in the ICT field. The UNAM ICT Strategy committee uses the national ICT strategy as a reference in its work.
8.6 Subjects and objects for assessment using the State Model/Extended State Model

State Model/Extended State Model subjects and objects:
- University Network. (State(s) and tasks and processes)
- Local Area Networks. (State(s) and tasks and processes)
- General Information Systems

University Network
UNAM has implemented the UNAM Network connecting most of the university buildings in a common university infrastructure, which is now in use. Now in use, the UNAM Network is subject to various modifications, mainly to increase bandwidth, to introduce high-performance hardware and software and to establish more Internet access points throughout the university campuses. In the Extended State Model, the UNAM network can be said to be in the U, M1/M2 and E States. Utilization is affected by low bandwidths both for the internal university network (Intranet) and for the link to the external Internet.

Local Area Networks
In the majority of buildings, around 60%, LANs have been acquired/developed and implemented. In these buildings the LANs are in the U, M1/M2 and E States. Maintenance is carried out more often than Modifications. The remaining 40% of the buildings are still waiting for funds for LAN acquisition/development. The planning and implementation of the LANs has not taken into account the nature of the services to flow, nor the demand based on the number of users in each building. The established university network is characterized by a very slow response time, which creates some frustration on the part of the users.

General Information Systems
The existing information systems have been established on the basis of identified needs of individual departments, which led to the implementation of administrative information systems, including the personnel/payroll, student records and finance information systems, in a package supplied by ITS. The university also runs a hostel students record system and kitchen and mess billing systems. A library information system (URICA) and an ID cards information system have also been implemented. SPSS is the statistical analysis package adopted by the university.

As a result of contacts and exchange of experiences with other universities UNAM recognizes the need for the establishment of standards for information systems selection, implementation and management, based on an ICT strategy. An external vendor supplies all existing application information systems. No in-house development unit currently exists, although a few local software programmes are maintained at the Computer Centre. The other campuses are linked to the main campus for e-mail service via telecomm facilities that extend 700 km.

Student Records Information System
The Student Records Information System is in the States U, M1/M2 and E. In the Utilization State, the Registrar runs activities such as data entry of new students, academic performance and new courses. The Registrar then makes use of that data to produce information for various entities such as the top management of the university, the faculties and students, and government bodies. In the M1/M2 state, the Registrar asks the CC staff, ICT service suppliers and ICT service consultants from time to time to introduce new functionalities. Such requests are not frequent. In the Extended State model all states are clearly defined and they are to be undertaken separately. Although modifications are not frequent, the combination of the two states creates an opportunity for conflicts between the users and the developers and creates a lack of confidence on the part of users.

Finance Information System
The Finance Information System is in the U, M1/M2, and E States. In the Utilization State, the Bursar runs activities such as financial accounting and budget data. This data is then used to produce financial information for the top
management of the university, academic and administrative units of the university, government bodies and donors. In the M1/M2 State, via the CC, the Bursar sometimes asks ICT service suppliers and ICT service consultants to introduce new functionalities. Introduction of new functionalities has not been frequent.

In the Extended State Model all states are clearly defined and they are to be undertaken separately. The different states have not been clearly demarcated. The combination of the two states creates an opportunity for conflicts between the users and the ICT service suppliers and creates a lack of confidence on the part of users.

**Payroll and Personnel Information System**

The Payroll and Personnel Information System is in the States U, M1/M2, and E. In the Utilization State, the Bursar runs the Payroll subsystem and the Human Resources Directorate runs the human resources management subsystem, in which activities such as data entry of new staff and staff absence are carried out. This data is then used by the payroll subsystem. In the M1/M2 state, the Directorate of Human Resources has asked ICT service consultants, via the CC, to introduce new functionalities. Functionalities have been changed frequently to accommodate requests from the top management of the university.

In the Extended State Model all states are clearly defined and they are to be undertaken separately. What is happening with the Payroll and Personnel Information System is in conflict with the extended state model because the two states are being done at the same time. The combination of the two states creates an opportunity for conflicts between the users and the developers and creates a lack of confidence on the part of users.

**Library Information System**

The Library Information System is in the U State. In the Utilization State, an integrated Library Information system (URICA) is in use, including an online public-access catalogue, a Web-based library catalogue providing students and academic staff with on-line access to worldwide information via the Internet. The number of access points and the speed of data transmission are very limited compared to the demand. It seems that in the planning stage, these aspects did not receive the attention required. This may soon force the ILRC to embark on the M1/M2 state.

**ICT-based distance education**

The university has also implemented the African Virtual University (AVU) programme. The AVU programme is in the state U. In the Utilization State, the AVU programme manager offers on a selective basis access to electronically interactive learning, up-to-date lectures, and Web-based learning to students and academic staff of UNAM. The integration of this programme in the education system of UNAM is still in its initial phase. Contacts are still going on with other suppliers of electronically interactive learning to introduce new courses. Course materials are not locally produced. UNAM provides space and students for ready-made courses from outside the country. In this way, students from Namibia interested in following the courses have to adapt themselves to the courses, which have been made abroad but are offered in the country. A positive aspect is that some staff at UNAM are already involved in online instructor courses offered as part of the university's partnership with Walden University in the USA. It is expected that shortly after instructors are trained, modifications will be introduced to the existing distance education programmes. Also, through a closed loop, UNAM runs open learning courses at UNAM main campus for staff and students. At the UNAM Northern Campus Open Learning project, pedagogical and technical support is provided to staff who are learning to use the recently installed interactive video education system.

The developments in distance education at UNAM show that multiple states, namely Development (D), Implementation (I), Utilization (U), are sometimes carried out at the same time. In the Extended State model, all states are clearly defined and they are to be undertaken separately. What is happening with the Distance Education System is in conflict with the extended state model because the
two states are being done at the same time. The combination of the two states creates an opportunity for conflicts between the users and the developers and creates a lack of confidence on the part of users and students.

Conclusions
The UNAM Network, which constitutes a centrally planned, developed/acquired, implemented and managed ICT infrastructure, is now in the Utilization State. Modifications are taking place to accommodate new technologies, to improve existing ones, and to provide more Internet access points.

LANs in different buildings of UNAM have been implemented and they are in use. In general the procedures used in the implemented general information system are not in line with the Extended State Model. Utilization takes place while new functionalities are being introduced. The combination of the States creates an opportunity for conflicts between users and developers and creates a lack of confidence on the part of users.

Information systems are implemented as their need is identified. They are opportunity based, not generally planned. Acquisitions are handled not only by the Computer Centre but also by individual faculties and administrative units. Donations of equipment and software may also be made to the Computer Centre or directly to other units. UNAM has a shortage of staff skilled in technical matters and in usage of the implemented information systems, which makes the university very much dependent on ICT service suppliers in the implementation of such systems. The existing information systems were not implemented with a clear demarcation between the states defined in the extended state model.

8.7 Subjects and objects for assessment using the Three Kinds of MCM Model and the Expansion of the Three Kinds of MCM Model

8.7.1 Functional Management (FM)

Organization
The CC, some faculties and administrative units undertake Functional Management tasks at UNAM. The decentralization processes implemented within the university include the decentralization of ICT. Therefore Functional Management is performed in university units owning ICT. Users perform Functional Management with the support of CC staff, staff of external ICT suppliers and ICT consultants. However, not all tasks related to FM are implemented.

Tasks
Table 8.7.1 provides an overview of tasks undertaken by the different parties involved in FM tasks. The mark (\(\checkmark\)) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.
### Table 8.7.1 - Functional Management tasks undertaken by the different parties at UNAM.

<table>
<thead>
<tr>
<th>Task Areas/Task Fields</th>
<th>University Computer Centre (CC)</th>
<th>Faculties and Administrative Units</th>
<th>External ICT Service Suppliers</th>
<th>ICT Consultants</th>
<th>University Top Management</th>
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<td>Strategic Management (SM)</td>
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<td>Technical Support (TSU)</td>
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<tr>
<td>• Hardware and Basic Software Support</td>
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<td>• Communication Support</td>
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<td>• DBMS support</td>
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<tr>
<td>• Management of (PC) application packages</td>
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<tr>
<td>• Research</td>
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<td>• Management of technical and communication facilities</td>
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<td>Personal Management</td>
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<td>• Personal Management</td>
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<td>General Business Support (GBS)</td>
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<td>• Quality Control</td>
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<td>• Capacity Planning</td>
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<td>• Budgeting</td>
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<td>• Charging Back</td>
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<td>• Acquisition of ICT Resources</td>
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<td>Operational Management (OM)</td>
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<td>Utilization Management (UM)</td>
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<tr>
<td>• User Support</td>
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<tr>
<td>• Functional System Management</td>
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<td>• Management Business Data</td>
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<td>Functional Maintenance (FM)</td>
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<td>• Maintenance of Manual Procedures</td>
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<td>• Data Definition Control</td>
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Processes
Processes related to FM are mainly undertaken by the CC. Such processes were presented in section 8.3, where the entity MCM was presented.

Procedures
Procedures for the realization of tasks are occasionally formulated and written down. The procedures are implemented in an ad hoc way and they are not rigorously followed and controlled.

People
**Number:** around 40 people are involved in FM  
**Education:** around 40% of staff have a university degree and have followed some sort of management course. Around 20% have actually followed ICT courses.  
**Experience:** The majority of the staff involved in FM have about five years of working experience.  
**Personnel turnover:** Staff involved in FM frequently obtain new jobs and leave the university.
8.7.2 Application Management (AM)

Organization
AM is performed mainly by the CC is the main entity involved but also by external ICT service suppliers and some units within the university such as ILRC. The external ICT service suppliers are mainly from outside Namibia.

Tasks
Table 8.7.2 provides an overview of tasks undertaken by the different parties involved in AM tasks. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

<table>
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<tr>
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<td>Technical Support (TSu)</td>
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<td>• Hardware and Basic Software Support</td>
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<td>Application Maintenance (AM)</td>
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<td>• Maintenance and Application Software</td>
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<td>• Database Management</td>
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Table 8.7.2 - Application Management tasks undertaken by different parties at UNAM

Processes
Processes related to AM are mainly undertaken by the CC. Such processes were presented in section 8.3, where the entity MCM was presented.

Procedures
Procedures for the realization of AM are not normally in written form. When they are, they are not rigidly followed.

People
Number: Around 40 people are involved in AM
Education: 20% of staff involved in AM have a university degree. 80% of staff involved in AM have followed some sort of ICT course.
Experience: Most staff involved in AM have more than five years of working experience.
Personnel turnover: In general, university staff involved in AM can easily get paid jobs outside the university and they leave.

8.7.3 Technical Management (TM)

Organization
Technical Management is performed in more than one unit within the university. It is mainly centralized at the CC, but the following units are also involved in TM: some university computer labs belonging to faculties and some faculties themselves, such as Engineering, the university top management, and the ILRC. Basic TM tasks are realized in the faculties, but complex TM tasks are performed by the CC. External hardware, software and communications suppliers are also involved in TM.

Tasks
Table 8.7.3 provides an overview of tasks undertaken by the different parties involved in TM tasks. The mark (\(\sqrt{\)}\) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

Processes
Processes related to FM are mainly undertaken by CC. Such processes were presented in Section 8.3, where the entity MCM was presented.

Procedures
Procedures for realization of TM tasks are not rigorously applied/realized

People
Number: The university has 15 staff members involved in the realization of TM tasks.
Education: around 5 of the staff members involved in TM have a university degree. Most of the 15 staff have followed ICT servicing courses.
Experience: Most of the university staff involved in TM have approximately five years of working experience in TM
Personnel turnover: Staff involved in TM are very volatile and staff turnover is very high.
<table>
<thead>
<tr>
<th>Task Areas/Task Fields</th>
<th>University Computer Centre (CC)</th>
<th>Faculties and Administrative Units</th>
<th>External ICT Service Suppliers</th>
<th>ICT Consultants</th>
<th>University Top Management</th>
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</thead>
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<tr>
<td><strong>Strategic Management (SM)</strong></td>
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<td><strong>Tactical Management (TM)</strong></td>
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<td>• Software Support</td>
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<td>• DBMS support</td>
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<td>• application packages</td>
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<td>• Management of technical</td>
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<td>and communication facilities</td>
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<td>• Budgeting</td>
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<td>• Charging Back</td>
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<td>• Acquisition of ICT</td>
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<td>• Resources</td>
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<td>Maintenance Technical Support (MTI-OS)</td>
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<td>• Changing Technical Infrastructure</td>
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<td>• Problem Management</td>
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<td>• Availability Control</td>
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<td>• Disaster Recovery</td>
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<td>• Security</td>
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<td><strong>Operational Control</strong></td>
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<td>• Acceptance</td>
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<td>• Operating</td>
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<td>• Hardware Configuration Management</td>
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<td>• Physical Data Management</td>
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<td>• Utilization Analysis</td>
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<td>• Performance Management</td>
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<td>• Tuning</td>
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<td><strong>Technical Services (TSe)</strong></td>
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<td>• Management of the Range and Cost of Services</td>
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<td>• Data Processing</td>
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<tr>
<td>• Advice and Participation</td>
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<tr>
<td>• Information Supply</td>
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</table>

Table 8.7.3 - Technical Management tasks undertaken by the different parties at UNAM

Conclusions
Although they are not recognized as such, the three kinds of MCM are realized in one way or another within the university. Processes and tasks to be performed under the three kinds of MCM are known, but are not completely followed because they are not fully understood. In all three kinds of MCM, the CC plays a major role. Realization of tasks and processes is not formalized. They are performed on an ad-hoc basis. For the amount of ICT available there are not enough skilled staff involved in the three Kinds of MCM. The few available skilled staff
have acquired knowledge through short ICT courses. The qualified staff, however, tend to leave the university for better-paid jobs.

The education system in Namibia does not offer ICT management courses in which skills in different types of management can be developed.

8.8 Drawing conclusions for the Big ICT Five

For the overall assessment of UNAM, we formulate the following conclusions in relation to ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization, and ICT service management:

Concerning ICT - strategy
The ICT strategy has not yet been finalised and approved at UNAM. Without the ICT strategy, the university lacks a means to address and apply important strategic subjects such as the definition of requirements and preconditions for the ICT needed to support education and research, determination of the costs of ICT services, and development of skills in the area of ICT.

While there is as yet no ICT strategic plan, its need is felt and its importance understood; work has begun on defining the content of the strategy. UNAM is looking for an ICT strategy that can provide an answer to the question: How can ICT be used to support the university’s main mission of education and research, in line with the expectations that Namibia holds for the university?

Concerning ICT – development/acquisition
With the shortage in skilled staff to undertake any in-house software development, UNAM has so far decided to rely on off-the-shelf software applications and ICT in general. Emphasis has been on ICT acquisition instead of ICT development. The main role of the existing ICT steering committee is restricted to acquisition procedures – and even then it does not have responsibility for all acquisitions; also, it operates on a case-by-case basis depending on the financing source for the ICT to be acquired. It is therefore difficult to maintain standards across the university and this in turn strains the capacity of the limited human resources.

In the acquisition process, UNAM misses out on important strategic subjects such as what application software should be acquired and how should it be made available and acceptable to users. For example, the university has acquired a software package to be adopted as a standard for word processing with a campus licence that has not been accepted by users. Such moves encourage a few units with some knowledge and financial resources to start acquiring their own information system, the implementation of which in many cases does not follow the States outlined in the State Model, resulting in aggregation of States which weakens the role of ICT to support the university. The benefits to be gained from a common approach to acquisitions are not widely recognised and accepted within the university. Given the dispersal of acquisition and procurement functions and the difficulty of relating donor contributions to overall university requirements there is a need for a more systematic approach that would bring centralised and decentralised acquisitions within a single inventory.

Concerning ICT - implementation
The university has great expectations of what ICT can deliver in support of its mandate. In this desire, many types of ICT are being implemented. The way in which implementations are taking place depends on the different ICT suppliers. Once the acquisition committee concludes the acquisition process of the centrally acquired ICT, university units generally handle their own implementation with the involvement of vendors or suppliers of ICT, sometimes with little involvement of the CC. In some cases the CC cannot respond promptly to requests from faculties because insufficient human resources. In this procedure, project management procedures are not rigorously applied. This allows faculties and administrative units to implement ICT without following the relevant procedures that would bring good
results from the ICT implementations within the university. ICT implementations neglect strategic issues such as prior definition of service level agreements with ICT service suppliers, resulting in weaknesses in the implementation. This makes it difficult to monitor the performance of the implemented systems and to ensure maximum benefit from scarce resources for systems support. However, it is understood by UNAM that implementation management is also of key importance, given the mix of internal and external resources available to bring in a variety of systems.

Concerning ICT – utilization
The utilisation of ICT is mainly PC-oriented, although multi-user systems are in place for administration of the academic processes, educational programmes and administrative processes. Computer laboratories are available to serve students and academic staff. Computer labs are the areas of most concentrated ICT use.

The ICT is not optimally used, however. In some areas there is insufficient ICT, and lack of knowledge prevents the academic, administrative staff and students from getting the best out of the ICT that is available. As most of ICT is acquired through donations within cooperation projects in which financial resources are instantly made available for capital investment, users have become less informed about and/or less sensitive to the different components of costs involved in ICT. Strategic actions geared to effective management of the ICT infrastructure and of the flow of users could expand the ICT user population within UNAM. These and other strategic issues such as understanding the ICT in/for use, know-how on ICT security in a university environment and more realistic assessments of training needs and costs need to be properly addressed.

Concerning ICT - service management
ICT service management is mainly centralised at the CC, but there are no formalised procedures in relation to support of the utilisation of ICT between the CC and faculties and administrative units. Service management could be improved if responsibilities were more clearly defined and understood throughout the university. Signed SLAs with ICT vendors should have a meaning and play a role within UNAM. The CC’s basic service menu is available on www.unam.na/centres/computer_centre/support.html but the level of its utilization by users requiring support services could not be traced. Strategic issues such as service delivery, user groups relationships, management of various components of ICT costs and realization of management tasks at an appropriate level, following defined procedures with periodic reviews, should be addressed. The university staff and student body has limited skills for technical ICT support and ICT management. UNAM with its large ICT infrastructure is now concerned about whether and how a disaster recovery programme could be implemented.
University of Swaziland (UNISWA)

Information about UNISWA was obtained from: UNISWA annual reports, strategic plan, other publications, www.uniswa.sz and field assessment, and was verified by the Director of the Computer Centre.

Swaziland
9. ASSESSING THE UNIVERSITY OF SWAZILAND (UNISWA) – SWAZILAND

Introduction
The objective is to assess the Big ICT Five in the University of Swaziland (UNISWA) by applying the models presented in Chapter 4. For the assessment we will follow the outline presented in Section 4.3 of Chapter 4.

9.1 Subjects and objects for assessment of the entity Real System using the MCM paradigm

In relation to the entity Real System, we focus on following subjects and objects:
- Historical background
- Location
- Organization
- Services
- Administration supporting education, research, and services
- People
- Situational Factors

Historical Background
The University of Swaziland developed from the University of Botswana, Lesotho and Swaziland (UBLS), formerly known as the University of Basutoland, Bechuanaland and Swaziland (UBBS), which had its headquarters in Lesotho between 1964 and 1975. The UBBS initially developed from the Pius XII Catholic University College at Roma (Lesotho).

Although the three Governments equally funded UBLS, it had comparatively little presence in Botswana or Swaziland in the first phase of its existence from 1964-1970. The only exception was the Faculty of Agriculture (constituted in 1972) at Luyengo in Swaziland. This faculty developed from the Swaziland Agricultural College and University Centre and opened in 1966. Meanwhile in Botswana, the UBLS presence was limited to the activities of the Division of Extra-Mural Services and a small short-course centre, which was built during 1969.

With independence, the three countries began to take a closer look at the colonial education inheritance and to identify the role of UBLS in the training of higher- and middle-level personnel. A series of academic planning reports for UBLS were produced after 1966, culminating in the second Alexander Report of 1970. This report recommended the establishment of university campuses in each country and the unified development of higher education and vocational and technical training. The Governments of Botswana, Lesotho and Swaziland accepted the recommendations in October 1970. Plans were drawn up for campus development in each of the three countries. There were to be new campuses within the capital city of Gaborone in Botswana and at Kwaluseni in Swaziland. Funds were obtained from the American, British, Canadian, Danish and Dutch governments as well as from the governments of the three founding countries and other bodies.

Following student unrest at Roma and strained relations between the central UBLS administration and the Lesotho Government, the Roma campus was precipitously withdrawn from UBLS and constituted as the National University of Lesotho (NUL) in October 1975. Students from Botswana and Swaziland were immediately withdrawn from the Roma campus. Teaching of these students was resumed within a few months in Botswana (Economics and Social Studies and Science) and in Swaziland (Law). The development of independent national universities was on its way. In June 1982, the University of Swaziland (UNISWA) received its university status.
Chapter 9 – Assessing the University of Swaziland (UNISWA) - Swaziland

Location
The main campus is at Kwaluseni. The Faculty of Agriculture is 24 km away, in Luyengo. The Faculty of Health Science is 30 km away from the main campus in Mbabane (the capital of Swaziland).

Organization
Organizational Structure
The organizational structure of UNISWA can be fitted into the Mintzberg logo as illustrated in Figure 9.1.1.

![Mintzberg Logo](image)

Figure 9.1.1 – The Mintzberg Logo applied to UNISWA

Education and Research
Education and research activities are undertaken within faculties/departments, institutes and research and service centres. Education and research in the area of ICT is offered by the Faculty of Science through the course in Computer Science. The curriculum for computer science comprises both computer science and mathematics modules. It normally takes four years to complete and delivers a B.Sc. degree. The Faculty of Sciences also offers the Physics and Electronic Engineering course, which includes computing-related disciplines in its curriculum. However, none of these courses provides ICT management courses. So far, research in ICT undertaken by the university has been aimed at supporting the teaching and learning activities.

The academic and non-academic staff directly involved in teaching-learning, research and extension services are attached to faculties and centres identified in Table 9.1.1.

In its courses, UNISWA offers graduation at the level of B.Sc. and post-graduate degrees and diplomas. Courses in various subjects are offered by its Institute of Distance Education and lead to various qualifications, such as a Certificate in French, Diploma in Law, Diploma in Commerce, B.A. in Humanities and B.Sc. in Adult Education.

Services
The university provides a number of services to support its main mission of education and research. Such services include:

Library - The university provides on-line services in its central library to students and academic staff. The central library provides support to students and academic
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<tr>
<th>Faculties (F1 – F8)</th>
<th>Courses</th>
<th>Staff</th>
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<th>Student population</th>
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<td>Academic</td>
<td>Non-Academic &amp; Administrative</td>
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<td>Agricultural Education and Extension</td>
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<td>Animal Production and Health</td>
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<td>F3. Faculty of Education</td>
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<td>Computer Science</td>
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<td>Computer Centre (not considered here)</td>
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<td></td>
<td>(Luvengo and Mbabane)</td>
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<td>13</td>
<td>9</td>
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<tr>
<td>University Computer Centre (CC)</td>
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<td>4</td>
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<td>Available units</td>
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<td>375</td>
<td></td>
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<tr>
<td>(Registry, Bursary, Maintenance and other units)</td>
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<tr>
<td>Total</td>
<td></td>
<td></td>
<td>295</td>
<td>513</td>
<td>3728</td>
</tr>
</tbody>
</table>

Table 9.1.1 - Academic, non-academic and student population by units and courses offered by UNISWA, 2000

164
staff in the form of books, journals and ICT facilities for accessing relevant information through the on-line public-access catalogue (OPAC). Other library services include reference assistance, circulation, inter-library loan, Internet and CD-ROM database searches and duplication.

Security - The university has security services to safeguard and protect its assets.

Social Services - The university provides social services to its students and staff, including health services, careers & counselling services, legal services, religious services, the bookshop and scholarships.

Housing - The university provides a limited amount of accommodation to full-time students, at the campuses of Luyengo and Kwaluseni.

ICT (5 staff) - The university has a Computer Centre (CC), which provides ICT services to the university.

Administration supporting education, research, and services

Figure 9.1.2 presents the organisational chart of UNISWA's administrative and managerial structure: the Officers of the University (Vice-Chancellor and one Pro Vice-Chancellor), University Council and Senate.

The Vice-Chancellor is the main authority within the university and is responsible for the administration of the whole university. In his daily activities he is assisted by the Pro Vice-Chancellor in the coordination of the activities of the following units: the Registry, the Academic Planning Office, the Academic Office, the Academic Personnel Office, the Board of Affiliated Institutions, the Non-academic Personnel Office, Publication and Information Office, Luyengo office, Mbabane office and the Computer Centre (CC). Under direct coordination of the Vice-Chancellor are: the Bursary, the Library, the Physical Planner/Maintenance, Faculties, Institute of Distance Education and the Consultancy and Training Centre.

The daily administrative activities are undergoing reforms aiming to provide the administration of the university with new and modern management tools that will allow it to support better the main mission of the university. As part of the ongoing processes under the UNISWA strategic plan and the ICT strategic plan, a set of administrative reforms are underway including the amalgamation of the Information Systems Unit with the Computer Centre to form the ICT Centre, the review of the Student and Personnel Information Systems, the review of the university’s organizational structure and procedures, and costing of the strategic plan (see Figure 9.1.3).

In UNISWA’s five-year ICT strategic plan (1999/2000-2004/2005), the university aims to undertake action in five major areas:

i. Upgrade ICT Infrastructures by upgrading its network infrastructure at the computer centre in all campuses, equip with up-to-date PC hardware and software three laboratories to be run by the computer centre for students and academic staff, and upgrade critical administrative computing systems (student records information system and the payroll information system).

ii. Organize ICT services and management by restructuring ICT divisions, set up ICT procedures in line with the policy, develop and provide management with information systems to enhance the decision making, and develop systems that give members of the university community easy access to relevant and pertinent information.

iii. Review human resources development and training programmes for ICT by employing and retaining ICT-skilled staff, setting up programmes for training ICT staff, setting up training sessions and seminars for staff to equip them with the necessary skills to make use of the available computer resources, and providing adequate and appropriate ICT staff/positions.

iv. Establish an enabling framework under which financing of ICT would take place, by providing adequate financial resources for ICT.
v. Work closely with other universities in the region in the ICT field, by participating in information and technology exchange programmes.

In this strategy, UNISWA has clearly made a substantial effort to cover relevant strategic issues, but it has also left out many strategic questions such as decentralization versus centralization, prioritisation of ICT coverage in the academic area for education and research activities, costs of ICT services (not only financial resources for ICT acquisition), ICT security, and ICT service management.

Figure 9.1.2 – Organization chart of UNISWA administrative structure, 2001
Strategic Objectives

- Facilitating the Achievement of equilibrium between the institution and the environment in which it operates
- Identifying priorities, based on mutually acceptable objectives and strategies
- Securing the coordination and harmonization of planning organs and levels
- Creating and strengthening programmes to reflect changing demands
- Facilitating organizational change by creating awareness of the need for change
- Providing opportunity for board participation
- Securing consensus commitment and action from stakeholders
- Establishing a basis for subsequent performance appraisal, monitoring and evaluation

Strategic Objectives

1.1 Upgrade present network infrastructure at the computer centre
1.2 Equip three laboratories at the computer centre with up-to-date PC hardware and software
1.3 Upgrade present network infrastructure in all campuses
1.4 Upgrade critical computing systems at ISDU
2.1 Restructure current ICT divisions
2.2 Provide adequate and appropriate ICT staffing/positions
3.1 Set up and maintain ICT policies and procedures
4.1 Provide adequate financial resources
5.1 Develop and provide management with information systems to enhance the decision making
5.2 Develop system that gives members of the University community easy access to relevant and pertinent information
5.3 Set up training sessions and seminars for staff to equip them with necessary skills to make use of available computing resources
6.1 Set up a programme for training ICT staff
7.1 Employ and retain skilled staff
8.1 Participate in information and technology exchange programmes

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<thead>
<tr>
<th>University</th>
<th>Government</th>
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</tbody>
</table>

Figure 9.1.3 - Ongoing processes at UNISWA
At the time of the assessment, UNISWA was just starting the implementation of its ICT strategic plan, and so much of what has been defined had still not been implemented. The two units that were dealing with ICT services were brought under one management in an attempt to respond to the need for restructuring within UNISWA. New hardware and software was being installed in attempt to respond to the identified need to increase access to ICT for students and the staff. Hardware and software installation was underway in three computer laboratories, and in the computer centre and the main backbone network infrastructure.

**People**
Academic staff; non-academic staff and students of UNISWA form the UNISWA population. The university population can be expressed as follows:

- **Numbers.** 295 academic staff and 513 technical and administrative staff are involved in education and research and support. UNISWA has 3726 students.
- **Education.** UNISWA academic staff all have university education. Around 40% of academic staff hold a Ph.D. degree. Around 10% of technical, administrative and support staff have completed a university degree.
- **Experience.** More than 75% of the staff in the two groups have six years of working experience or more. Around 50% of the experienced academic staff do not have a PhD.
- **Personnel Turnover.** Most university staff who are trained or educated oversees return to the university. However, most staff also have paid jobs outside the university and are therefore unable to devote all their time to the university.

**Situational Factors.**

- **Specific situational factors.** Culture of the organization, and Starting point for ICT.
  - **Culture.** The university is open to students from all social classes. Admission to university courses is based on academic merit. Members of the collegial organs of the university are elected and major decisions of the university are made in these organs. The fact that Swaziland is a monarchy has a great influence on the operating of the university. The university values and maintains all elements of the traditional culture of Swaziland. UNISWA fights discrimination of all types.
  - **Starting point for ICT.** UNISWA is a relatively new university as it was only established in 1982. Traditionally UNISWA is not a technological university. The use of ICT in education and research is relatively new. At the beginning of the 1990s, the student records and payroll information systems were introduced, based on in-house software development. A computer science course combined with a mathematical course was introduced at UNISWA only recently. This gave UNISWA the opportunity to start with relatively advanced ICT. To date, the university keeps pace with changes in technologies and ICT is spread over the campus.

- **Generic situational factors.** Relationships with ICT suppliers and discontinuity of management
  - **Relationships with ICT suppliers.** Relationships with ICT suppliers are on an ad-hoc basis.
  - **Discontinuity of management.** Leaders in the academic units (faculties/departments) rotate every three years. In some cases this causes discontinuity of management, which in turn can influence the strategy of the university negatively as it may delay the implementation of some of the strategic decisions made by previous managers.

**Conclusions**

Education and research at UNISWA also cover education and research in the area of ICT. In the ongoing internal reforms the university has established a five-year strategic plan for ICT. The content of the strategic plan suggests that the university intends to increase the use of ICT, not only for education and research but also for the supporting administrative systems.
The ICT strategy covers relevant strategic issues, although clearly missing others such as ICT security, ICT cost, ICT centralization and decentralization, and ICT service management. Furthermore, it does not address clearly the issue of lack of ICT skilled human resources and its implications within the constraints in which UNISWA operates.

9.2 Subjects and objects for assessment of the entity ICT using the MCM paradigm

In relation to the entity ICT, we focus on the following subjects and objects:
- Complexity factors.
- Hardware/Software/Communication characteristics
- Data set characteristics
- Procedures' characteristics

Complexity factors.
- **Quantity.** 463 PCs, a number of communication facilities, 3 operating systems and 11 application software packages are available. ICT within UNISWA is growing through the increase of new computer labs and Internet connection points.
- **Diversity.** UNISWA has various types of ICT components from different manufacturers and origins. This forces the university to have relationships with suppliers of all these types of ICT components. ICT suppliers are mainly based in South Africa.
- **Distribution.** UNISWA has its ICT dispersed over its different locations.
- **Dynamics.** Changes in hardware and software are made regularly at UNISWA. The staff of the CC faculties and ICT suppliers introduce changes in hardware and software. Changes are not controlled. They are made on an ad-hoc basis.
- **Functionality.** ICT is employed for different functions within UNISWA.
- **Relationships.** The existing ICT is networked but the administrative systems have not been linked to the network.
- **Ownership.** The university owns the ICT. The Vice Chancellor has delegated some of his responsibilities to the heads of academic and administrative units. The delegation of responsibilities also includes responsibility for the ICT that is allocated to them. Responsibilities for configuration management have, however, been delegated to the newly established ICT service unit.
- **Utilization.** In each academic or administrative unit the users utilize the ICT available. Academic staff and students access and utilize ICT differently from administrative staff. While academic staff and students use the available ICT freely for their specific individual needs, administrative staff apply ICT only for specific tasks. For example, the Bursar’s staff can only use ICT in the Finance Management Information System.
- **Sophistication.** The university ICT is fairly advanced for the existing skills within UNISWA. The majority of the university staff have insufficient knowledge of the available ICT, which makes it difficult for them to understand it and to use and/or service it properly.

To illustrate the complexity of ICT, we refer to Figure 9.2.1, which shows the variety/diversity in communication facilities. Table 9.2.1 gives information about the capacity of these communication facilities.
Figure 9.2.1 – UNISWA ICT infrastructure
<table>
<thead>
<tr>
<th>Type</th>
<th>Topology</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Backbone</td>
<td>Fibre Optic</td>
<td>Star</td>
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<tr>
<td>Local Area Networks</td>
<td>UTP</td>
<td>Star</td>
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<td>Metropolitan Network</td>
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<tr>
<td>Wide Area Network</td>
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<td>Wireless Technology</td>
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<tr>
<td>Internet</td>
<td>Leased Data Line</td>
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</tr>
</tbody>
</table>

Table 9.2.1 - Communications facilities capacity at UNISWA, 2001

Hardware/Software/Communication characteristics, such as:  

Network capacity. The ICT at the main campus consists of a number of Novell LANs (Ethernet 10 Mb/s) dispersed among the campus buildings. The ICT of each building is connected with concentrated computing facilities by fibre optic. This creates a star-shaped network. The concentrated computing facilities connect via a leased line (64 kb/s at a cost of 750 Rand per month) to the LANs of the Faculty of Agriculture in Luyengo. The Faculty of Health Sciences has a dial-up connection for e-mail delivery and retrieval through UUCP, which is not linked through the concentrated computing facilities to the main campus. UNISWA gets Internet access via a 64 Kb CISCO Router to South Africa at FRD.  

Standardization. Standardization has not been planned.  

Quality of technical facilities. The technical facilities are of high quality, up to date with the last market releases and versions.

Datasets characteristics, such as:  

Extent. The existing databases are small in size, a hundred megabytes for the Finances Information System, Library Information System, Student Records Information System and Payroll and Personnel Information System.  

Standardization. There is little standardization of databases.

Database management Software. Oracle and Access database management software are applied within UNISWA.

Procedures characteristics, such as:  

Number. The total number of procedures is not known.

Extent. Procedures are based on practices. Few are in written form.

User friendliness. The existing written procedures are very descriptive. The entities issuing such procedures cannot determine how user friendly these are.

Language. The existing procedures are mainly written in English, the official language. Technical documentation is written in English.

Conclusions
UNISWA already has an extensive ICT infrastructure and a substantial number of components. The available ICT are of several types and from different makes and origins. A good understanding of this highly complex ICT infrastructure is required, as are well-defined user groups. The university also requires professional ICT service management to support the implementation and utilization of its ICT in accordance with requirements, pre-conditions and situational factors, so that it may contribute to the university’s core business in a positive way.
9.3 Subjects and objects for assessment of the entity MCM using the MCM paradigm

In relation to the entity MCM, we focus on the following subjects and objects:
- Organization
- Tasks with reference to tasks areas and task fields
- Processes
- Procedures
- People

Organization
The Management, Control and Maintenance (MCM) of the ICT supporting the university are centralized in the University ICT Centre (CC) but mainly entrusted to the external ICT service suppliers. In some faculties, such as the Faculty of Engineering, first-line support (consisting of problem identification and small repairs) is handled by local academic and administrative staff. Some external ICT services, such as the national PTO, the public electricity company, and the national Internet supplier, also undertake some MCM activities in a multiple relationship also involving UNISWA and ICT Suppliers. ICT Acquisitions may be carried out by CC, by faculties, by the Bursary or other UNISWA units, either through purchase or donation.

The CC operates as an ICT service unit for the entire university. UNISWA’s major objective for the CC, as stated in the ICT strategy, is to provide support for UNISWA’s ICT services. In this regard, the CC provides:
- advice and support to UNISWA units during ICT planning and development stages;
- procurement and installation of ICT hardware and software;
- software development for administrative systems, such as the student records information system and the payroll information system;
- technical ICT implementation, maintenance and support services;
- user training.

Within UNISWA, these activities are undertaken through specialized units and staff as indicated in Figure 9.3.1.

![Computer Centre organisation chart of UNISWA, 2001](figure)

The 5 CC staff are organized as follows to perform MCM functions:
- The CC Manager, with the Technologist, performs MCM functions for the whole university in the areas of Internet provision, operating systems installation, hardware installation and maintenance, LAN installation and maintenance, and the main university network. The Technologist also serves as the help desk manager, mainly to answer calls from users when they need ICT service support. These two CC staff members are also responsible for the UNISWA ICT inventory.
- The System Analyst and the programmers are responsible for the development of software for some administrative services.
• The CC Manager and the System Analyst have joint responsibility for selecting hardware and software for the centrally acquired ICT and installation and maintenance of ICT. In this they liaise with ICT service suppliers.

The CC Manager, together with the technical staff, is heavily involved in operational technical management of technical tasks such as hardware installation and maintenance, network management and repairs. The same team is also involved in management tasks such as ICT planning, monitoring ICT implementations, maintaining relations with ICT service suppliers, and participating in meetings within and outside UNISWA.

Tasks
According to the summary of the MCM paradigm and the Three Kinds of MCM/Expansion Models presented in Chapter 4, management tasks can be found and performed within the MCM entity of the MCM paradigm and within the three kinds of MCM, forming Functional Management (FM), Application Management (AM), Technical Management (TM). In the MCM entity, such tasks are realized in more than one organization. Within UNISWA, the CC, which has a certain level of organization and some experience, performs most of the TM. AM and FM are weakly performed. Section 9.7 will describe in more detail all tasks and the organizations performing them, using the model Three Kinds of MCM.

Processes
Incident Management. Incidents are logged into the existing Help Desk. The Help Desk is located at the CC. As soon as incidents are logged into the Help Desk, a technical CC staff member is assigned the task of visiting the unit/user that reported the incident. First-line support is given. When the incident cannot be managed by the CC’s technical staff, ICT suppliers are called in for in-depth investigations and restoration of services. The response time is relatively rapid (within a few hours). In general most of the incidents reported are cleared. The solutions provided are not always recorded in writing.

Problem Management. The staff of the CC and ICT suppliers carry out some form of problem management. In general problems are solved but without going to their root cause. As a result problems often recur some time after the repair. Thus problem management is not dealt with professionally.

Change Management. Whenever new ICT is acquired, some form of change management takes place. CC staff, faculty staff members and ICT suppliers perform some change management on an ad-hoc basis. Changes are not formalized.

Configuration Management. Occasionally configuration management for hardware and software takes place. In general, faculties and administrative units undertake ICT acquisition independently. Sometimes however, these units acquire ICT through the CC. Sometimes donations are made directly to CC or to other units within the university. This makes it difficult to maintain a university-wide inventory of ICT of the university. After ICT is acquired or donated, the acquisitions/purchasing officer labels it and delivers it to the university unit concerned.

Release Management. No release management takes place.

SLA Management. Service Level Agreement Management is very weak. SLAs signed at the central level of UNISWA with ICT suppliers are not formalized in agreements with university units. The perception of the users within the university is that the Computer Centre should serve their needs as required. There is no SLA between the CC and other university units. This leaves room for accusations of lack of performance by the parties involved.

Capacity Management. There is no capacity management.

Contingency Management. No contingency management is done.

Availability Management. UNISWA has no availability management of its relatively large ICT infrastructure.

Cost Management. Some sort of cost management is done.
Network Services Management. Network service management is performed by CC.

Procedures in written form, verbal form
Most of procedures for the realization of MCM tasks are orally expressed. A limited number of procedures performed by the CC and by the external ICT service suppliers are in written form in English, the official language. Support documentation consists mainly of the technical and user manuals/ documentation supplied together with hardware and software, written in English.

People
Number. Around 10 people from the CC, some faculties, and external ICT suppliers realize MCM tasks in one way or another.
Education. Around 20% of staff realizing MCM tasks work in the CC and have some understanding of such tasks.
Experience. Around 10% of staff dealing with MCM tasks have many years of working experience in their field of ICT operation. This number is insufficient to handle, in a professional manner, all the service management needed.
Personnel Turnover. University staff with MCM skills can easily obtain well-paid jobs outside the university. With the exception of the ten most experienced CC staff, staff tend to leave the university as soon as they have enough experience and have completed a certain number of ICT courses. As an example, a UNISWA staff member who was sent abroad for training in ICT to work in the CC resigned from the university while still abroad, as soon as he had finished his studies. He returned to Swaziland to get a new job outside the university.

Conclusions
The MCM at UNISWA is centralized at the CC, which therefore plays an important role in the realization of MCM tasks. CC staff are overloaded with work, especially the CC Manager and the System Analyst. Some faculties also perform some MCM tasks. Not all MCM processes are covered. The ones that are performed are not done at an appropriate level. Most SLAs are not formalized. Those formalized with ICT suppliers are not fully known to users and few procedures are in written form. MCM tasks are executed on an ad-hoc basis. Most of them are expressed orally. ICT service management still does not include many MCM tasks that need to be carried out systematically and professionally if ICT is to provide a positive influence on education and research at the UNISWA.

9.4 Subjects and objects for assessment of internal relationships using the MCM paradigm

In relation to the internal relationship, we focus on the following subjects and objects for assessment:

Relation RS → ICT. Requirements and preconditions
The university exploits the Student Records Information System, the Payroll and Human Resources Information System, the Finance Information System, the Library Information System and the UNISWA Network for its own benefit. Requirements and preconditions for these information systems have been formulated. The lack of skilled users and training programmes to improve skills prevent the university from getting the best out of the ICT.

Relation RS ← ICT. Way of support
The Student Records Information System, the Payroll and Personnel Information System, the Finance Information System, the Library Information System and UNISWA Network support the university in its activities relating to students, staff, finances and education and research. Information generated by the ICT cannot always be extracted in a timely manner, because of the limited number of qualified users.

174
Chapter 9 – Assessing the University of Swaziland (UNISWA) - Swaziland

Relation ICT ➜ MCM. Kind of data to support MCM
The Student Records Information System, the Payroll and Personnel Information System, the Finance Information System, the Library Information System and UNISWA Network support the technical staff of CC and ICT services suppliers by supplying them with data. The advanced state of the ICT, the lack of skills to use it and the amount of data generated do not always permit the proper interpretation and response to this data.

Relation ICT ← MCM. Way of management
In collaboration with the user departments, the technical staff of the CC and ICT suppliers provide support to the available ICT for the Student Records Information System, the Payroll and Personnel Information System, the Finance Information System, the Library and UNISWA Network. The support provided comes from a multiplicity of support units, but there is insufficient coordination. As many AM and TM tasks are not carried out and the available data may be incorrectly interpreted, in many cases decisions are not supported by the data provided.

Relation RS ➜ MCM. Requirements and preconditions
The university employs CC technical staff to manage the Student Records Information System, the Payroll and Personnel Information System, the Finance Information System, the Library Information System and the UNISWA Network. In this relationship the university has not established SLAs stating the requirements and preconditions which should be fulfilled by the CC in support of the ICT strategy.

Relation RS ← MCM. Way of support
Technical staff members of the CC respond to users’ requests within university. There are no formalized SLAs governing such requests. The CC management has some understanding of the importance of SLAs but unfortunately it cannot start the process of establishing SLAs without the consent of UNISWA’s top management. CC staff respond to requests as part of their duties as employees of the university. There was found to be a prevailing perception in the university that, if SLAs were signed, the university units would not be able to afford to pay for the services.

Conclusions
The university has formulated requirements and preconditions for the existing ICT. Areas covered by ICT support are clearly defined. Lack of skilled users prevents proper utilization of ICT and therefore the university cannot get the best out of it. The lack of qualified people who understand the sophisticated ICT also prevents units performing MCM tasks related to Functional Management, Application Management and Technical Management from taking timely decisions based on the data generated by the ICT. This creates weaknesses in the ICT services management.

UNISWA has not established formal service level agreements with units employed by the university to perform MCM tasks. Requests made for ICT services are handled on an ad hoc basis. Without service level agreements, defining strategic issues such as ICT services to be offered and the level at which they have to be delivered, the cost of such services cannot be determined. There is no framework under which the CC and the rest of the university can be made accountable for carrying out their responsibilities under the ICT strategy. Payment for services seems to be one of the main reasons for not establishing service level agreements, but the cost of not having SLAs can be even higher.

9.5 Subjects and objects for assessment of the external influences using the MCM paradigm

Economy
Although Swaziland is rated as poor by world standards [ACR2000], it is the tenth wealthiest country in Africa. Swaziland is a small country with a small dependent economy, and this does not encourage openness to the outside world. The government does very little to support
exports. As a land-locked country it is completely dependent on South Africa for transport and shipping; electricity costs are extremely high and not supportive of manufacturing. The major source of revenue is tourism. UNISWA buys most of its equipment, supplies and teaching materials, including books, abroad.

Education
For its population of 1.061 million in 1999 [ACR2000], the Government of Swaziland is improving the quality of education in cooperation with the private sector. South Africa and Britain are influential in all aspects of the Swazi education system. An important focus is the development of the technical, entrepreneurial and managerial skills which are vital for the full exploitation of the country's natural resources. To develop these skills will require improvement in the ICT infrastructure of the university, as well as the training programmes it offers.

Governance
Swaziland is a monarchy. The Chancellor of the university is the King of Swaziland. The Vice-Chancellor, pro-Vice-Chancellor and chief executive officers of the units run the university. The University Council is made up of members appointed by the Chancellor (7), the Minister of Education (4), the Senate (3), graduates (2), the academic and administrative staff (1), the Attorney General, 3 members of senior management and two former external vice-chancellors. This body, together with the Senate, is the governing body of UNISWA. It deals with planning, acquisition of funds and implementation of academic and administrative programmes. For the year 2000, the government provided only 68.8% of the financial resources requested, but promised a 5% annual increase in funding. The university is to establish a performance contract with the Swaziland Government in which the expectations of the government and the university will be clearly set out. The governance of the university is stable but this could change given its dependence on the monarchy.

Donors
There is little cooperation between UNISWA and donors in the area of ICT. In the 1990s there was limited cooperation with VUA of Holland during which the Student Records and Personnel Information systems were developed. These systems are still in use. Attempts to start cooperation with UK on a training programme were not sustained because the trained person left the university after the first period of training in the United Kingdom. At the moment there are no co-operation programmes relating to ICT with international donors. The university relies on government resources and its own revenues. Lack of donor-funded projects may simplify ICT management but it also limits the extent to which both technology and expertise can be made available within the university and serves to isolate it from global ICT trends.

On the other hand, donors contribute greatly to financing ICT programmes at national level, although in many cases they pressure national institutions to reshape their programmes to fit their agendas. ICT acquisition, for example, is very much influenced by the interests of the donor countries or organizations. This negatively influences the implementation of most of the projected ICT because implementation does not take into account the important issues of sustainability and skills building. Some donors organize frequent ICT promotional activities in distant parts of the world, which draw skilled resources away from national ICT objectives and disperse the small concentration of skills. This can create delays in ICT implementations and also gives less time to the few skilled staff to provide a professional ICT service.

ICT suppliers
Swaziland, for geographical and political reasons, is influenced greatly by the South African economy. In the field of ICT, this influence is seen in the following:

- a great many hardware brands can be found in Swaziland;
- most vendors are dealers who sell limited but expensive after-sales services;
- some vendors/suppliers can drive or fly in and out of Swaziland in the same day.
Chapter 9 - Assessing the University of Swaziland (UNISWA) - Swaziland

The guarantees on hardware and software offered by ICT dealers often expire before their suppliers manage to get the hardware and software to the end users. Moreover, the dependence on South Africa makes it difficult to provide reliable and timely technical support.

Telecommunications is a monopoly. As it has no need to compete, the national telecommunications company introduces technological change very slowly. Although it has introduced some digitised circuits, it still runs analogue circuits to most public subscribers while most of the private sector already has digital infrastructure on its premises. The university relies on a 64 Kbits connection to South Africa for Internet access. The telecommunications monopoly creates an environment characterized by high-cost ICT services and restrictions on service provision, and selective telecommunications services, facilities and coverage. This is not conducive to the identification and adoption of new technologies.

Conclusions
UNISWA is governed by civil service rules and is influenced on a daily basis by government policies. Its close relationship with government means that decisions are not always within the purview of university governance; they have a political dimension, and can also be delayed by bureaucratic processes which influence the implementation of the university strategy negatively.

The level and quality of application and use of ICT by staff in education and research activities is greatly influenced by where the staff received their education. Swaziland has a very limited staff with skills in ICT, a situation that is reflected also within UNISWA. Most Swazis who acquire reasonable ICT skills try other job markets. They often leave Swaziland, mainly for South Africa, and the ICT is left without people to use or service it.

Although the economy of Swaziland is in a reasonable position by African standards, the statistics reflect an economy that is geared to supporting external investors, mainly in agriculture and tourism. Technology industry, in particular ICT industry, has not been a priority in Swaziland. The financing of the social sector to which the UNISWA belongs has not met the needs of the sector. This negatively affects implementation of institutional strategies, which in many cases have good plans but few funds for the implementation of the planned activities.

Donors contribute mainly to financing ICT programmes at the national level, although in the past UNISWA has also had donor cooperation in the ICT field. ICT programmes may be very much influenced by the interests of the donor organizations rather than by those of the receiving institutions, leading to insufficient attention being paid to issues of sustainability and skills development. Donor activities may also divert skilled workers from their normal duties.

Major European, American and Asian brands of hardware, software and communication technologies can be found in Swaziland. South-African ICT companies service most of this diverse and dispersed ICT.

9.6 Subjects and objects for assessment using the State Model/ Extended State Model

In relation to this Model, we focus on the following subjects and objects
- University Network. (State(s) and tasks and processes)
- Local Area Networks. (State(s) and tasks and processes)
- General Information Systems
University Network
UNISWA has implemented the UNISWA Network connecting most of its buildings in a university common infrastructure, which is now in use. Whilst in use, UNISWA Network is now subject to various modifications, mainly to increase bandwidth, to introduce new high-performance hardware and software and to establish more Internet access points throughout the university campuses. In the Extended State Model, UNISWA Network can be said to be in the U, M1/M2, and E States. Utilization is affected by low bandwidths both for the internal university network (Intranet) and for the external link to Internet.

Local Area Networks
In about 70% of buildings, LANs have been acquired/developed and implemented. In these buildings the LANs are in the U, M1/M2, and E States. Maintenance is carried out more often than Modifications. The remaining 30% of the buildings are still waiting for finance for LAN acquisition/development. The planning and implementation of the LANs has not taken into account the nature of the services to flow, nor the demands of the number of users in each building. The university’s established network is characterized by a very slow response time, which creates some frustration on the part of the users.

General Information Systems
The existing information systems have been established on the basis of the identified needs of individual departments. Administrative information systems include personnel/payroll and finance information systems, designed and developed both in house by the ex-ISDU (Information Systems Dissemination Unit, which has become part of the CC) and VUA from Netherlands. The library information system was acquired off the shelf from application software vendors. The integrated Library Information System, with an online, public-access catalogue, provides students and academic staff with on-line access to worldwide information. Statistical analysis packages are also available for use within the university.

Student Records Information System
The Student Records Information System is in the States U, M1/M2, and E.
In the Utilization State, the Registrar runs activities such as data entry of new students, academic student performance and new courses. The Registrar then makes use of that data to produce information for various entities such as the top management of the university, the faculties and students, and government bodies. In the M1/M2 state, CC staff are asked by the Registrar to introduce new functionalities. Such requests are frequent.

In the Extended State Model all states are clearly defined and they are to be undertaken separately. With modifications being made while the system is in use, the combination of the two states creates an opportunity for conflicts between users and the developers and creates lack of confidence on the part of users.

Library Information System
The Library Information System is in the U State.
In the Utilization state, the integrated Library Information System, with the online, public-access catalogue, provides students and academic staff with on-line access to worldwide information. The number of access points and the speed of data transmission are very limited and it appears that insufficient attention was given to these aspects in the planning stage.

Finance Information System
The Finance Information System is in the U, M1/M2, and E States.
In the Utilization State, the Bursar runs activities such as financial accounting and budget data. This data is then used to produce financial information for the top management and academic and administrative units of the university, government bodies and donors. In the M1/M2 State, ICT service suppliers and ICT service
consultants are asked by the Bursar to introduce new functionalities. Introduction of new functionalities has not been frequent.

In the Extended State Model all states are clearly defined and they are to be undertaken separately. Demarcation of the different states is not clearly implemented. The combination of the two states creates opportunity for conflicts between users and the ICT services suppliers and creates lack of confidence on the part of users.

Payroll and Personnel Information System
The Payroll and Personnel Information System is in the States U, M1/M2.
In the Utilization State, the Bursar runs the payroll subsystem and the Human Resources Directorate runs the human resources management subsystem, in which activities such as data entry of new staff, and staff absence are carried out. This data is then used by the payroll subsystem. In the M1/M2 state, ICT service consultants are asked by the Directorate of Human Resources, via the CC, to introduce new functionalities. Changes to functionalities have been made frequently to accommodate requests from the top management of the university. Most of the ICT services suppliers are South-Africa-based companies, which are not necessarily responsive to the needs of the university.

In the Extended State Model all states are clearly defined and they are to be undertaken separately. What is happening with the Payroll and Personnel Information System is in conflict with the Extended State Model because the two states are being done at the same time. The combination of the two states creates an opportunity for conflicts between users and the developers and creates lack of confidence on the part of users.

Conclusions
The UNISWA Network, which constitutes a centrally planned, developed/acquired, implemented and managed ICT infrastructure, is now in the Utilization State. Modifications are taking place to accommodate new technologies, to improve existing ones, and to provide more Internet access points. LANs have been implemented in different buildings of UNISWA and they are in use.

In general the procedures used in the general information systems implemented are not in line with the Extended State Model. Utilization takes place while new functionalities are being introduced. The combination of the two states creates opportunity for conflicts between users and the developers and creates lack of confidence on the part of users. Donations of equipment and software may also be made to the computer centre or directly to other units.

UNISWA has a shortage of skilled technical staff and users for the information systems implemented, which makes the university very dependent on ICT service suppliers for system implementation. The information systems have not been implemented correctly in accordance with the stages indicated in the Extended State Model.

9.7 Subjects and objects for assessment using the Three Kinds of MCM Model and the Expansion of the Three Kinds of MCM Model

9.7.1 Functional Management (FM)

Organization
Functional Management tasks are mainly undertaken by the CC. The decentralization processes implemented within the university include the decentralization of ICT, and therefore Functional Management is also performed in some university units (faculties and administrative units) owning ICT. Users perform Functional Management with the support of
CC staff and external ICT services suppliers’ staff. Tasks related to FM, however, are not implemented fully.

**Tasks**

Table 9.7.1 provides an overview of tasks undertaken by the different parties involved in FM tasks. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

<table>
<thead>
<tr>
<th>Task Areas/Task Fields</th>
<th>University Computer Centre (CC)</th>
<th>Faculties and Administrative Units</th>
<th>External ICT Service Suppliers</th>
<th>ICT Consultants</th>
<th>University Top Management</th>
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<td>• Management of (PC) application packages</td>
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Table 9.7.1 - Functional Management tasks undertaken by the different parties at UNISWA.

**Processes**

Processes related to FM are mainly undertaken by the CC. Such processes were presented in Section 9.3, where the MCM entity was presented.

**Procedures**

Procedures for the realization of tasks are occasionally formulated and written down. The procedures are implemented ad hoc and they are not rigorously followed and controlled.

**People**

Number: Around 30 people are involved in FM
Education: 10% have a university degree and have followed some sort of ICT management course.
Experience: Most of the staff involved in FM have more than five years of working experience. Personnel turnover: University staff involved in FM often find new jobs and leave the university.

9.7.2 Application Management (AM)

Organization
Application Management at UNISWA is undertaken mainly by the CC and by some UNISWA administrative units such as the library. Application management is performed mainly by users, but also by software application suppliers' staff, mainly from outside Swaziland. The units involved in the AM tasks are thus: the CC, some administrative units, and ICT suppliers.

Tasks
Table 9.7.2 provides an overview of tasks undertaken by the different parties involved in AM tasks. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

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<thead>
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Table 9.7.2 - Application Management tasks undertaken by different parties at UNISWA

Processes
Processes related to AM are mainly undertaken by the CC. Such processes were presented in Section 9.3, where the MCM entity was presented.

Procedures
Procedures for the realization of AM are not normally in written form. In the cases where they are, they are not rigidly followed.
Chapter 9 – Assessing the University of Swaziland (UNISWA) - Swaziland

People

**Number:** Around 10 people are involved in AM

**Education:** 60% of the staff involved in AM have a university degree and have followed some sort of ICT course.

**Experience:** Most staff involved in AM have more than five years of working experience.

**Personnel turnover:** In general university staff involved in AM easily find better-paid jobs outside university and they tend to leave the university.

### 9.7.3 Technical Management (TM)

**Organization**

Technical Management tasks at UNISWA are carried out mainly by the CC but also by the computer lab of the Engineering Faculty; i.e. Technical Management is performed in more than one unit within the university. Basic TM tasks are realized in the faculty but complex TM tasks are performed by the CC. Hardware, software and communications suppliers are also involved in complex TM tasks.

**Tasks**

Table 9.7.3 provides an overview of tasks undertaken by the different parties involved in common TM tasks. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

**Processes**

Processes related to TM are mainly undertaken by the CC. Such processes were presented in Section 9.3, where the MCM entity was presented.

**Procedures**

Procedures for realization of TM tasks are not rigorously applied/realized.

**People**

**Number:** The University has five staff members involved in realization of TM tasks.

**Education:** Three have university degrees and have followed ICT courses.

**Experience:** The university staff members involved in TM have more than 5 years of working experience.

**Personnel turnover:** Turnover of staff involved in TM is very high.
### Task Areas/Task Fields

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<tr>
<th>Task Areas/Task Fields</th>
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<td>• Management of (PC) application packages</td>
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<td>• Research</td>
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<td>• Management of technical and communication facilities</td>
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<td>Personal Management</td>
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<td>• Personal Management</td>
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<td>General Business Support (GBS)</td>
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<td>• Administrative Management</td>
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<td>• Quality Control</td>
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<td>• Capacity Planning</td>
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<td>• Order Control</td>
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<td>• Budgeting</td>
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<td>• Charging Back</td>
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<tr>
<td>• Acquisition of ICT Resources</td>
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<td>Operational Management (OM)</td>
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<td>Maintenance Technical Infrastructure and Operational Support (MTT-OS)</td>
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<td>• Changing Technical infrastructure</td>
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<td>• Problem Management</td>
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<td>• Availability Control</td>
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<td>• Disaster Recovery</td>
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<td>• Security</td>
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<td>Operational Control</td>
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<td>• Acceptance</td>
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<td>• Operating</td>
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<td>• Hardware Configuration Management</td>
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<td>• Software Configuration Management</td>
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<td>• Physical Data Management</td>
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<td>• Utilization Analysis</td>
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<td>• Performance Management</td>
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<tr>
<td>• Tuning</td>
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<td>Technical Services (TSe)</td>
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<tr>
<td>• Management of the Range and Cost of Services</td>
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<tr>
<td>• Data Processing</td>
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<td>• Advice and Participation</td>
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<td>• Information Supply</td>
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</table>

Table 9.7.3 - Technical Management tasks undertaken by the different parties at UNISWA.

### Conclusions

Although they are not recognized as such, the three kinds of MCM are realized in one way or another within the university. Processes and tasks to be performed under the three kinds of MCM are not very well known and those which are known are not fully understood. In all three kinds of MCM the CC plays major role. Realization of tasks and processes is not formalized and they are performed on an ad-hoc basis. For the amount of ICT available there is a skills shortage within university for the Three Kinds of MCM. The CC has very few staff, and those available have acquired their knowledge of MCM tasks through short courses and on the job training. With the exception of the manager, the qualified staff tend to leave the university for better-paid
jobs. The education system in Swaziland does not offer ICT management courses in which skills for different types of management could be developed.

9.8 Drawing conclusions for the Big ICT Five

For the overall assessment of UNISWA we formulate the following conclusions in relation to ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization, and ICT services management:

Concerning ICT-Strategy
The recently formalized ICT strategy is an integrated part of the UNISWA strategy to support education, research and administration of the university. However, at the time of the assessment, the ICT strategy was still in an early stage of implementation. It is not clear whether sufficient technical or managerial capacity exists to implement the strategy successfully. A strategy that does not have clear implementation guidelines linked to the available capacity cannot achieve the desired results.

Some relevant strategic subjects are covered by the ICT strategy. However, some strategic subjects have not been dealt with, such as ICT security, ICT centralization versus ICT decentralization, issues of costs associated with ICT–acquisition, and implementation servicing. Strategic issues of knowledge and skills for ICT utilization and ICT service management are also neglected. There is clearly a need within UNISWA for better understanding of the purpose of an ICT strategy, its implications and the constraints within which it must operate.

The limited cooperation with other organizations in ICT projects – and the dependence on South Africa – means that the University is isolated from main global ICT trends and has difficulty building its own secure ICT environment.

Concerning ICT – Development/Acquisition
UNISWA has a limited budget for acquisition of the ICT it needs. Involvement of the CC in deciding what to acquire and for what purpose is limited. It is therefore difficult to maintain standards across the university and this strains the capacity of the limited human resources, making it impossible to take advantage of bulk purchasing opportunities offered by ICT companies. For its administrative systems, such as the student records and payroll information systems, UNISWA opted for in-house development, even at an early stage of ICT development in the university, taking advantage of the cooperation with VUA. But these developments did not take place within a framework of options for acquiring off-the-shelf or developing application packages. The present ICT strategy of UNISWA omits important strategic issues, such as in what circumstances an information system should be developed in-house or, alternatively, acquired from software houses. This allows the few units with some knowledge and financial resources to develop their own information systems, a process which in many cases does not follow the States outlined in the State Model. This leads to aggregation of States, which weakens the role of ICT to support the university.

The potential benefits from common approaches to acquisitions are not widely recognised and accepted within the university. Given the dispersal of acquisition and procurement functions and the difficulty of relating donor contributions to overall university requirements, a more systematic approach is needed, to bring centralised and decentralised acquisitions within a single inventory. An acquisitions committee exists but has only limited control over the ICT acquisitions for the university as a whole.

Concerning ICT – Implementation
In general, university units handle their own implementation with the involvement of vendors or suppliers and/or the CC, which, because of lack of capacity, cannot always respond promptly to requests from the faculties. Project management procedures are not rigorously applied. Thus faculties and administrative units are allowed to start implementation of ICT without following relevant procedures that would bring the ICT implementations within the
university to a successful outcome. ICT implementations are not mindful of strategic issues such as prior definition of SLAs with ICT service suppliers, thus weakening the ICT implementation. This makes it difficult to monitor the performance of the implemented systems and to obtain maximum benefits from scarce resources for systems support. In the absence of good system documentation, it can also complicate support and troubleshooting.

Concerning ICT - Utilization
The utilization of ICT is mainly PC-oriented. Few multi-user systems are in place for administration of academic processes, educational programmes and administrative processes. Computer laboratories to serve students and academic staff are available in some faculties but the greatest concentration of PCs for students is at the CC. ICT utilization is not optimal and insufficient ICT and lack of knowledge prevent the academic, administrative staff and students from fully exploiting the available ICT.

There are few formal processes or procedures in relation to the utilization and modification of ICT among the ICT service providers and beneficiaries. There is no information with respect to the utilization of Internet programs. As most of the ICT was acquired through cooperation projects in which donated funds were instantly available for capital investment, users have become less informed about and/or less sensitive to the costs of ICT and the different components of these costs.

Strategic actions geared to effective management of the ICT infrastructure and of the flow of users could expand the ICT user population within UNISWA. These and other strategic issues such as understanding the ICT in use, know-how on ICT security in an university environment, and more realistic assessments of training needs and costs need to be properly addressed by UNISWA.

Concerning ICT - service management
ICT service management is mainly centralised at the CC, although some faculties such as the Faculty of Science attempt to support their own ICT up to certain level. There are no formalised procedures between the CC and faculties and administrative units in relation to support of ICT utilisation. Service management could be improved if responsibilities were more clearly defined and understood throughout the university. SLAs should have a meaning and play a role within UNISWA. Many strategic issues are not considered, including service delivery, user group relationships, management of the various components of ICT costs, and the need for management tasks to be realized at an appropriate level, following defined procedures with periodic reviews.
University of Zambia (UNZA)

Information about UNZA was obtained from UNZA annual reports, strategic plan, other publications, www.unza.zm and field assessment, and was verified by the Director of the Computer Centre.

Zambia
10. ASSESSING THE UNIVERSITY OF ZAMBIA (UNZA) - ZAMBIA

Introduction
The objective is to assess the Big ICT Five in the University of Zambia (UNZA) by applying the models presented in Chapter 4. For the assessment we will follow the outline presented in Section 4.3 of Chapter 4.

10.1 Subjects and objects for assessment of the entity Real System using the MCM paradigm

In relation to the entity Real System, we focus on following subjects and objects:
- Historical background
- Location
- Organization
- Services
- Administration supporting education, research, and services
- People
- Situational Factors

Historical background
The establishment of a university in Lusaka was first considered in the early 1950s, but proposals were abandoned in 1953 following the creation of the Federation of Rhodesia and Nyasaland and the decision to establish a University College in Salisbury (now Harare).

Almost ten years later the question of a university for Northern Rhodesia was formally re-opened by the government, which, for the first time, consisted of a majority from the two nationalist parties, the United National Independence Party and the African National Congress. In March 1963, the government appointed a commission under the chairmanship of Sir John Lockwood, which unanimously recommended the establishment of a university in Lusaka. This was accepted by the government. Following Zambia's independence, the President, Dr. Kaunda, was installed as Chancellor on 12 July 1966 and the following day laid the foundation stone for the university of Zambia on the Great East Road Campus.

The university began with three Schools: Education, Humanities and Social Science, and Natural Sciences - but as facilities developed and needs were recognized new Schools were added: Law (1967); Engineering (1969); Medicine (1970); Agricultural Sciences (1971); Mines (1973); Business and Industrial Studies (1978, at Ndola Campus); Environmental Studies (1981, at Ndola Campus); and Veterinary Medicine (1983).

In the first academic year (1966) the university enrolled 312 students and by 1976, student numbers had risen to over 4000. It was envisaged that eventually the total enrolment would level off at about 8000 students. Since such a number could not be accommodated, academically or residentially, at the main campus in Lusaka, it was decided in 1975 that the university would be developed on a federal basis and that it would comprise three constituent institutions: one at Lusaka, one at Ndola and the third at Solwezi in the North-Western Province.

However, in 1987, the Act that ushered in a federal structure for the university was reviewed and it was decided to abolish this structure. Following the advent of the third Republic in November 1991, two Acts were passed establishing two autonomous universities, namely the University of Zambia and the Copperbelt University. Act Number 26 of 1992 introduced important changes in the university governance, providing for a titular chancellor, appointed by the President on the basis of proposals from the Minister of Education. Previously the President had been the Chancellor of the two universities.
**Location**
The main university campus covers about 290 hectares and is situated on the south side of the Great East Road, about 9 km from the town centre in Lusaka. Also in Lusaka is the Ridgeway Campus, of about 9 ha.

**Organization**

**Organizational Structure.** The organization structure of UNZA can be fitted into the Mintzberg logo as illustrated in Figure 10.1.1.

![Diagram](image)

**Figure 10.1.1 – The Mintzberg Logo applied to UNZA**

**Education and Research.** Education and research activities are undertaken within the Schools/Faculties/and Departments shown in Table 10.1.1.

In relation to education and research in the area of ICT, a computer science course is offered by the Faculty of Natural Sciences. The computer science course takes four years and leads to a B.Sc. degree in Computer Studies. After a one-year general course in the School of Natural Sciences or elsewhere at UNZA, students come to the Department of Computer Studies for the remaining three years of the B.Sc. degree programme, which offers two options: Software Engineering (SE) and Computer Systems Engineering (CSE). M.Sc. and MA degrees require two more years of study.

Distance education implemented by UNZA is managed at two levels: nationally, at the UNZA main campus in Lusaka, and provincially, in the 9 centres which have been established in the provinces. The centres are located in Choma and Livingston in the Southern province, Mongu in the Western province, Kabwe in Central province, Solwezi in Northwestern province, Kitwe in Copperbelt province, Chipata in Eastern province, Mansa in Luapula province and Kasama in Northern province.

The staff and physical infrastructure for the execution of distance education in Lusaka are attached to the Directorate of Distance Education (DDE). The staff and physical infrastructure for implementation of distance education in the other provinces are attached to the Faculty of Education and Humanities and Social Sciences(HSS). The fact that DDE is establishing its programme using staff and
<table>
<thead>
<tr>
<th>Faculties /Schools (S1-S7)/ Academic Units</th>
<th>Courses/Departments</th>
<th>Staff</th>
<th>Student Pop.</th>
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<td>Animal Science</td>
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<td></td>
<td>Crop Science</td>
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<td>S2. School of Education</td>
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<td></td>
<td>Educational Administration &amp; Policy Studies</td>
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<td></td>
<td>Educational Psychology, Sociology &amp; Special Education</td>
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<td>Library and Information Studies</td>
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<td>Languages &amp; Social Sciences Education</td>
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<td>In-Service Education &amp; Advisory Services</td>
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<td>S3. School of Engineering</td>
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<td>Zambia Law Journal</td>
<td>-</td>
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<td>Institute of Economic &amp; Social Research (INESOR)</td>
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<tr>
<td>Directorate of Research &amp; Graduate Studies (DRGS)</td>
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<tr>
<td>Directorate of Distance Education (DDE)</td>
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<tr>
<td>University Library (UL)</td>
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<tr>
<td>University Computer Centre (CC)</td>
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<td>Administrative Units (Management, Support Services, Students Affairs, Security)</td>
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<td>Total</td>
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Table 10.1.1 - Academic, non-academic and student population breakdown by units and courses offered by UNZA, 2001
infrastructure belonging to other university units has required considerable coordination between DDE and the Faculty of Education together with HSS.

None of the courses offered by UNZA provides ICT management skills. So far, research undertaken by the university is aimed at supporting the teaching and learning activities.

**Services**
The university also runs a number of services that directly or indirectly provide support to its main mission of education and research. These services include:

- **Transport.** The university provides transportation to the students, academic and administrative staff (buses that are run by a university administrative unit).
- **Library.** The university runs a central library, which hosts many books and articles that can be accessed manually and electronically. The library also provides books and international publications, distributes journals in the campus and provides Internet access for students.
- **Security.** The university has a security unit (Internal Protection and Security Unit), whose main responsibility is safeguarding UNZA premises and goods. This unit is supported by rented services from outside the university.
- **Social Services.** The university runs social services for students, including student accommodation and provision of food.
- **Housing.** The university manages housing facilities for academic and administrative staff. A decision made within university has allowed staff to become owners of the university houses under certain conditions and consequently the university is losing its assets. This was a result of a national program, referred to as People Empowerment ICT. The university has a Computer Centre (CC), which provides ICT services within the university, as well as some services to outside parties on a charge basis.

**Administration supporting education, research, and services**
The organizational chart of the UNZA's administrative and managerial structure - the Officers of the University (Vice-Chancellor and Deputy Vice-Chancellor), the University Council and the University Senate - is presented in Figure 10.1.2.

The Vice-Chancellor is the main authority within the university and is responsible for the administration of the whole university. In his duties he is assisted by the Deputy Vice-Chancellor. The Vice-Chancellor and his deputy constitute the university's top management and under their coordination are deans and directors of academic units, the Bursar, the University Librarian, the Chief Internal Auditor, the University Architect, the Registrar, the Purchasing Suppliers Manager, the Public Relations Manager, the Staff Development Officer, the Senior Administrative Officer, and the Management Secretaries I and II.

Education and research activities are coordinated by the top management and implemented by the deans/directors of schools and research units. The administration supporting education and research is done in the other units named above.

Acquisition of hardware and software is formalized within the norms and procedures for general acquisition of goods for the university and is led by the Purchasing Manager. There is no specific procedure for ICT acquisition, which has a negative impact on the university. The centralized procedures for general acquisitions do not prevent units with funds from acquiring whatever they want.

The Bursar manages the university's funds, mainly coming from the state budget, and provides support to the whole university in financial administration matters. The University Architect centralizes the administration of new construction and the maintenance of the university's physical infrastructures. The Staff Development Officer centralizes the
university's human resources management and training programmes and, in co-ordination with the Bursar, manages the payroll of the staff.

Figure 10.1.2 - Organization chart of University of Zambia administrative structure, 2001

The daily administrative activities are being streamlined in reforms, aiming to provide the university with new and modern management tools that will enable better support to the main
Strategic Objectives

1. To enhance the quality and relevance of undergraduate education and training
2. To expand the capacity for postgraduate training
3. To develop capacity for high quality and relevant research
4. To provide opportunities for lifelong learning to all that are willing and able to benefit, at all stages of life
5. To strengthen the services that the University provides to the economy and to the society
6. To stimulate and encourage education and training of kinds in the country
7. To enhance the international perspective of the University's academic activities, and to foster a network of relationships with higher education institutions in Zambia and elsewhere
8. To diversify the University's sources of funding
9. To transform the management and others structure of the University
10. To enhance the management of the University's resources
11. To enhance equitable access

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</table>

1. The need for an ICT Strategic Plan
2. The importance of efficient and effective computing services to support Academic programs
3. Mobilization of Resources for modernizing the University Library and increasing access to information through the use of ICT
4. "Learning modules" for degree and other programmes for transmission through ICT
5. Specification and implementation of an Information Service strategy
6. A Management Information System (MIS) for the more effective and efficient management of resources
7. The University's strategic objectives in this area of ICT are:
   7.1 To strengthen the use, maintenance, planning and management of ICT at the university in order to enhance the University's core business
   7.1.1 Enhancing the services that the network provides to the community
   7.1.2 Finalizing the information services strategy, taking cognisance of the need to rationalize the information services and software applications that the University can support
7.2 To ensure that students are provided with appropriate services and facilities

Figure 10.1.3 - On Going Processes at UNZA, 2001
mission of the university. As part of the ongoing reform process (see Figure 10.1.3) UNZA has prepared its 2002-2006 Strategic Plan, which calls for the design of an ICT Strategy, an Information Services Strategy and a Distance Education Strategy. The principal arguments given by UNZA for designing such strategies are: the need to strengthen the use, maintenance, planning, and management of ICT at UNZA to support education and research; the need to enhance the services that the UNZA Network provides to the UNZA community, ensuring that students are provided with appropriate ICT services and facilities; more effective mobilization of resources for modernization of the university library and increased access to information through the use of ICT; the need to develop learning modules for degree programmes and other programmes for transmission through ICT; and the need to develop a management information system (MIS) for more effective and efficient management of resources.

At the time of our assessment, preparation of the ICT strategic plan at UNZA had not started. Nevertheless, UNZA was looking for an ICT strategy that can answer the question: How can ICT be used to support the university’s main mission of education and research, in line with the expectations that Zambia holds for the university? Even without an ICT strategy, UNZA continues to make substantial investments in the acquisition and implementation of ICT. Clearly there are risks that could be minimized by implementing the ICT within an approved framework and common vision.

People
Academic staff, non-academic staff and students of UNZA form the UNZA population. This population can be expressed as follows:

Numbers. 474 academic staff (full professors, associate professors, senior lectures, lecturers I, II, III) and 1937 non-academic and administrative staff (senior librarians, senior technical professionals, senior administrative staff, junior administrative staff, secretarial staff, etc.). UNZA has 4,544 students, of which 111 are part-time.

Education. 100% of the academic staff have at least a university degree. About 20% of the administrative staff hold university degree in their respective fields.

Experience. Over 70% of UNZA staff have more than 5 years of working experience in their respective fields. UNZA is losing a substantial number of its staff because of HIV/AIDS.

Personnel Turnover. University staff members, particularly academic staff, can easily obtain better-paid jobs outside university, but few actually decide to leave the university.

Situational Factors
Specific situational factors. Culture of the organization, and Starting point for ICT.

Culture. According to its Strategic Plan, UNZA is committed to maintaining the highest attainable levels of quality with regard to teaching and learning, research and service to society. Through quality assurance mechanisms, the university ensures that students and staff are performing and achieving the standards set by the university. Access to university education is extended to under-represented social groups such as women, the disabled, the elderly, individuals from remote rural areas and disadvantaged groups. The university is committed to a system of continuing education and training for all at all stages of life by applying modern ICT if needed.

The same document states that the university seeks the truth in all its activities and promotes a culture of peace. It defends academic freedom and adherence to rigorous accountability and quality assurance systems. The university is for the strengthening and development of strategic linkages with the world of work and national and world-class international institutions.

Students and staff, as stakeholders, will be represented in all the key decision-making organs of the university. The university will work to eliminate gender
discrimination, and individual and enterprise initiatives are encouraged and rewarded by the university.

Starting point for ICT. In the late 1970s UNZA introduced substantial computer facilities to support its activities. These were largely centralized in the running of the Mainframe Computer (an IBM 4361), which was used by both students and administrative systems, and until 1996-1997 this same computer was used to process all of Zambia’s secondary school examinations for the Ministry of Education. To date UNZA has kept pace with technological change and ICT is now spread throughout its campuses.

General situational factors. Relationships with ICT suppliers and discontinuity of management.

Relationships with ICT suppliers. Relationships with ICT suppliers are conducted on an ad-hoc basis.

Discontinuity of management. Rotation of leaders in the academic units (faculties and departments) takes place every two and four years depending on position of appointment. In some cases this creates discontinuity of management, which can have a negative influence on the implementation of the university’s strategy. The top management has experienced serious discontinuity from time to time, which has created some uncertainty within the university community.

Conclusions
Education and research at UNZA also covers education and research in the area of ICT. In the ongoing internal reforms, UNZA has identified the need to design an ICT strategy. Currently UNZA is not addressing some relevant strategic issues in the implementation of ICT, with negative consequences. The university’s Strategic Plan lists a series of statements that should form the basis of the future ICT strategy, but these leave out strategic subjects such as costs and budgeting of ICT services and the decentralization of ICT services and its management. There is clearly a need within UNZA for better understanding of the purpose of an ICT strategy, its implications and the constraints within which it must operate.

10.2 Subjects and objects for assessment of the entity ICT using the MCM paradigm

In relation to the entity ICT, we focus on the following subjects and objects:

- Complexity factors.
- Hardware/Software/Communication characteristics
- Dataset characteristics
- Procedures’ characteristics

Complexity factors.

Quantity. 1100 PCs, a number of communication facilities, 4 operating systems and 15 application software packages are available. ICT within UNZA is growing with the increase in new information systems, computer labs and Internet connection points.

Diversity. UNZA has various types of ICT components from different manufacturers and origins, which forces the university to have relationships with many different ICT suppliers.

Distribution. UNZA has its ICT dispersed throughout its different locations.

Dynamics. Changes in hardware and software take place slowly. The staff of the CC, faculties and ICT suppliers make changes to hardware and software in an ad-hoc manner. There is no planned maintenance.

Functionality. ICT is employed for different functions within UNZA.

Relationships. The existing ICT is networked, but the linkages with the administrative systems have not been concluded.
Ownership. The university owns the ICT. The Vice-Chancellor has delegated some of his responsibilities to the heads of academic and administrative units. This delegation also includes responsibility for the ICT that is allocated to them.

Utilization. The users in each academic or administrative unit utilize the ICT available. There is, however, a difference in access and utilization by academic staff and students and the administrative staff. The first two use the available ICT in a free form for specific individual needs. The administrative staff is tied to more specific tasks and it is here where ICT is applied. For example, the Bursar’s staff can only use ICT in the form of the Finance Management Information System.

Sophistication. The University ICT is very advanced. Most of the university staff have insufficient knowledge and understanding of the available ICT, which makes it difficult for them to use and/or service it profitably.

To illustrate the complexity of ICT, Figure 10.2.1 shows the variety and diversity of the communication facilities and Table 10.2.1 gives information about their capacity.

<table>
<thead>
<tr>
<th>Type</th>
<th>Topology</th>
<th>Capacity</th>
<th>Beneficiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Backbone Fibre Optic</td>
<td>Bus-Star</td>
<td>10 Mb</td>
<td>Students, Academic and Administration Staff</td>
</tr>
<tr>
<td>Local Area Networks UTP</td>
<td>Star</td>
<td>10 Mb</td>
<td>Students, Academic and Administration Staff</td>
</tr>
<tr>
<td>Metropolitan Network Wireless UTH</td>
<td>Star</td>
<td>32 Kb</td>
<td>Students, Academic and Administration Staff</td>
</tr>
<tr>
<td>Wide Area Network Wave LAN (INESOR)</td>
<td>Point to Point LAN</td>
<td>32 Kb</td>
<td>Students, Academic and Administration Staff</td>
</tr>
<tr>
<td>Internet Dedicated Link to Zamnet</td>
<td></td>
<td>96 Kb</td>
<td>Students, Academic and Administration Staff</td>
</tr>
</tbody>
</table>

Table 10.2.1 - Communication facilities capacity at UNZA, 2001

Another radio link has been established to extend the network to the School of Medicine (SOM) and to the Institute of Economic and Social Research (INESOR). The radio link has enabled a 41.6% increase in LAN points. The wireless technology is a private network and belongs to the university. The dial-up connections are made via the Public Telephone Operator. Bandwidth for Internet access is very limited. Demand consistently exceeds supply, which is a frustrating factor for the UNZA community.

Standardization. The planned standardization of ICT has not yet been implemented.

Quality of technical facilities. The technical facilities are of high quality, up to date with latest market releases and versions.

Dataset characteristics, such as:

Extent. The existing databases are of small and medium size: a few hundred megabytes for each of the following systems: the Finance Information System, Student Records Information System, and Payroll and Personnel Information System.

Standardization. Planned standardization of ICT is far from implementation. At the time of the assessment, there was little standardization of databases.

Database Management Software. Informix and Access database management software are applied within UNZA.

Procedures characteristics, such as:

Number. The total number of procedures is not known.

Extent. Procedures are based on practices. Few are written.
User friendliness. The existing written procedures are very descriptive. The entities issuing such procedures are not very concerned about their user friendliness.

Language. The existing procedures are mainly written in English, the official language. Most technical documentation is also written in English.

Conclusions
UNZA has an extensive ICT infrastructure and a huge number of components. The available ICT are of several types and from different manufacturers and origins. A good understanding of this highly complex ICT infrastructure is required. For ICT to have a positive influence on the university’s core business, well-defined user groups are also needed, together with professional ICT service management to support the implementation and utilization of the ICT in accordance with requirements, pre-conditions and situational factors of the university.

Figure 10.2.1 - University of Zambia ICT infrastructure

10.3 Subjects and objects for assessment of the entity MCM using the MCM paradigm

In relation to the entity MCM we focus on the following subjects and objects:
- Organization
- Tasks with reference to tasks areas and task fields
- Processes
- Procedures
- People
Chapter 10 – Assessing the University of Zambia (UNZA) - Zambia

Organization
The Management, Control and Maintenance of the ICT which supports the university is mainly centralized in the university’s Computer Centre (CC). The Computer Centre was established soon after the foundation of the university to provide computing facilities for teaching and research and to satisfy the needs of the university administration for data processing facilities.

Some MCM activities are also undertaken by some schools, such as the School of Engineering and the School of Natural Sciences, and by external ICT service suppliers, such as the national PTO, the Public Electricity Company and the UNZANet (ZAMNET).

UNZA’s major objective for the CC, as stated in the Strategic Plan, is to support the whole university in the process of ICT planning, deployment, training, management and maintenance. In this regard, the CC provides:
- advice and support to UNZA units during ICT planning and development stages;
- procurement and installation of ICT hardware and software;
- technical ICT implementation, maintenance and support services;
- user training.

Within the CC, these activities are undertaken through specialized units and staff as indicated in Figure 10.3.1.

![Figure 10.3.1 - UNZA Computer Centre organization chart](chart)

MCM functions are performed by 25 staff of the University Computer Centre (of which 17 are technical staff) within the following departments:
- Consultancy and Training Unit (CTU): This unit provides training and consultancy services in the area of ICT for academic and administrative UNZA units but also to the external clients on charge basis. The CTU is directly involved in establishing relations with its clients. It generates financial resources for the CC.
- Information Services Managements (ISM): This unit is responsible for software development, software customization and software maintenance, and both database
software and applications software. It provides support to users within the university.

- Networks and Software Support Management (NSSM): this unit is responsible for computer hardware, communication hardware, operating systems installations, tuning, and maintenance. It provides support to users within the university.
- Telecommunications Management (TIM): this unit provides first-line support to users in the telecommunications services.
- The Director of the Computer Centre is not involved in operational technical management. He is responsible for the management of the Centre and consultancy services.

Tasks
According to the summary of the MCM paradigm and the Three Kinds of MCM/Expansion models presented in Chapter 4, management tasks can be found and performed within the MCM entity of the MCM paradigm and within the Three Kinds of MCM: Functional Management (FM), Application Management (AM), Technical Management (TM). In the entity MCM, these tasks are realized in more than one organization. Within UNZA, the CC, which has a certain level of organization and some experience, performs most of the TM. AM and FM are weakly performed. Section 10.7 sets out in detail all tasks and the organizations performing them, using the model Three Kinds of MCM.

Processes

**Incident Management.** Incidents occurring in the PCs, networks and general use application software, such as MS Office, are logged into the existing Help Desk and recorded in a form at the CC and are then handed over to the technicians in the Networks Support, Hardware and Maintenance, and Software Support units. Other incidents are reported directly to the technical or administrative units at the CC. In either case, when the incident cannot be managed, external service suppliers are involved in in-depth investigations and restoration of services. In general, most of the incidents reported are cleared. Solutions provided are not always recorded.

**Problem Management.** The CC staff realize some form of problem management. In general, problems are solved, but without going to their root cause.

**Change Management.** New ICT is acquired and as a consequence some form of change management takes place in the existing ICT and services. Tasks executed are a direct consequence of adding functions to the existing ICT, mainly in the use of general application packages and Internet tools and the administrative information system. Staff of the CC, schools and ICT service suppliers perform some change management tasks on an ad-hoc basis. Change management is not a formalized process.

**Configuration Management.** Configuration management of hardware and software hardly takes place. The inventory and stock management unit undertakes the centrally planned ICT acquisitions. The CC and administrative units may, however, undertake ICT acquisition independently and sometimes these units acquire ICT through the CC. Donations are made directly to the CC or to other units within the university. This makes it difficult to maintain a university-wide inventory and it has not been possible for UNZA to keep a reliable register of all hardware and software. During the assessment, it was not possible to get a list of the available hardware and software.

**SLA Management.** Service Level Agreement Management is not undertaken. Service levels to be provided are not formalized in agreements with UNZA units and they cannot be properly controlled and evaluated. This leaves room for accusations of lack of performance by the parties involved.

**Capacity Management.** Some capacity management is performed. The lack of resources has not allowed UNZA to provide sufficient ICT capacity to meet the education and research needs of the university as a whole. Internet service delivery is particularly poor.
Availability Management. Without SLAs in which the availability of ICT services would be stated, the Schools, CC and administrative units can only undertake some sort of availability management on an ad-hoc basis.

Cost Management. Some sort of cost management is done by the CC, Schools and administrative units, although it is not recognized as such by all parties involved.

Network Services Management. UNZA owns a large ICT infrastructure Network (UNZANet). Network services management is performed by the CC, which carries out the tasks of introducing (adding) new networks (mainly LANs in the faculties and administrative units) and making changes in the existing ones.

Procedures in written form
Most of the procedures for the realization of MCM tasks are orally expressed. A limited number of procedures performed by the CC and external ICT service suppliers are written down in English, the official language. Supporting documentation consists mainly of the technical and user manuals/ documentation supplied with hardware and software and is written in English.

People

Number. Around 50 people from the CC, Schools and external ICT service suppliers realize MCM tasks in one way or another.

Education. Around 25 staff realizing MCM tasks have some understanding of them; the majority are with the CC.

Experience. Around 20% of staff dealing with MCM tasks have many years of working experience in their field of ICT operation. This number is insufficient to handle professionally all the service management needed.

Personnel Turnover. University staff with MCM skills can easily obtain well-paid jobs outside the university. With the exception of the ten most experienced CC staff, staff tend to leave the university as soon as they have acquired enough experience and have attended enough ICT courses.

Conclusions
The MCM at UNZA is centralized at the CC, which thus plays an important role in the realization of MCM tasks. UNZA Schools and external ICT service suppliers also perform some MCM tasks.

All the technical units of the CC are understaffed. The existing staff is overloaded with work and little time exists for systematizing work processes. Not all MCM processes are carried out and those that are, may not be done at an appropriate level. SLAs are not formalized and few procedures are in written form, most being orally stated. Bandwidth for Internet access is very limited. Demand consistently exceeds supply, which is a frustrating factor for the UNZA community.

Lack of working conditions, skills and incentives are all contributing factors to the poor performance of MCM tasks. ICT service management at UNZA still leaves out a lot of MCM tasks which need to be performed professionally, systematically and appropriately to support the university's key tasks.

10.4 Subjects and objects for assessment of internal relationships using the MCM paradigm

In relation to the internal relationships, we focus on the following subjects and objects for assessment:

Relation RS → ICT. Requirements and preconditions
The university exploits for its own benefit the Personnel and Payroll Information System (PPIS), Student Records Information System (SRIS), Accounting Information System (Chameleon 2000, which is being replaced by CS3) and UNZANet. Requirements and
preconditions for this ICT have been formulated. The lack of skilled users and training programmes to improve skills prevent the university from getting the best out of its ICT.

Relation RS ← ICT. Way of support
The Personnel and Payroll Information System (PPIS), Student Records Information System (SRIS), Accounting Information System (Chameleon 2000, which is being replaced by CS3) and UNZANet support the university in its activities relating to students, staff, finances and education and research. It is not always possible to extract information generated by the ICT when needed because of the limited number of qualified users.

Relation ICT → MCM. Kind of data to support MCM
The Personnel and Payroll Information System (PPIS), Student Records Information System (SRIS), Accounting Information System (Chameleon 2000, which is being replaced by CS3) and UNZANet support the technical staff of the CC and ICT service suppliers by supplying them with data. The advanced ICT and lack of skills on the part of staff do not always allow proper interpretation of the data generated by ICT.

Relation ICT ← MCM. Way of management
Technical staff at the CC and staff from suppliers provide support to the available ICT in collaboration with the user departments of the Personnel and Payroll Information System (PPIS), Student Records Information System (SRIS), Accounting Information System (Chameleon 2000, which is being replaced by CS3), and UNZANet. Because AM and TM tasks are not carried out and the available data are sometimes interpreted wrongly, in many cases situations are created where decisions are not supported by the data provided.

Relation RS → MCM. Requirements and preconditions
The university employs the CC technical staff to manage the Personnel and Payroll Information System (PPIS), Student Records Information System (SRIS), Accounting Information System (Chameleon 2000, which is being replaced by CS3) and UNZANet. In this relationship the university has not established detailed SLAs in which the requirements and preconditions to be fulfilled by CC are stated.

Relation RS ← MCM. Way of support
Technical staff members of the CC respond to requests from users within the university. There are no formalized SLAs governing such requests. The CC has made some attempts to design SLAs but unfortunately they have not been formalized and units within university are not bound to the SLAs designed by CC. CC staff respond to these requests as part of their duties as employees of the university.

Conclusions
The university has formulated requirements and preconditions for the existing ICT. Areas covered by ICT support are clearly defined. Lack of skilled users prevents proper utilization of the available ICT. Moreover, the lack of qualified people who understand the sophisticated ICT also prevents the units performing MCM tasks related to Functional Management, Application Management and Technical Management from taking timely decisions based on the data generated by the ICT. This creates weaknesses in the ICT service management. UNZA has not established formal service level agreements with units employed by the university to perform MCM tasks. Requests made for ICT services are handled on an ad hoc basis. Without service level agreements, which define strategic issues such as ICT services to be offered and the level at which they have to be delivered, the cost of such services cannot be determined. There is no framework under which the CC and the rest of the university can be made accountable for the ICT strategy. Payment for services seems to be one of the main reasons for not establishing service level agreements, but the cost of not having SLAs can be even higher.
10.5 Subjects and objects for assessment of the external influences using the MCM paradigm

Economy
Zambia is rated as one of the poorest countries in the world [ACR2000]. The university – and the ICT applications within it – is one of very many legitimate claimants on the national budget and for donor funds. The cost of bureaucracy is very high, resulting in a less than attractive environment for investment in general and in particular in the area of ICT. There are few prospects for the development of a local ICT industry.

Given the limited funding available from government for university ICT programmes, UNZA needs external resources to meet its ICT needs, but must set up separate financial and administrative systems to guarantee proper reporting and to ensure a flow of external funds. Until donors have confidence in national financial management, it will be difficult for UNZA to obtain large-scale funding for ICT development.

Education
Human resources to implement, use and support ICT within the university are extremely limited. There are very few people within the country with the technical and management skills needed for successful ICT implementation. UNZA strives to keep the qualified staff that it trains. The market outside the university pays more and thus attracts many qualified staff. Staff have been trained both in Zambia and outside the country (Europe and Africa), providing different and unbalanced levels of skills in the ICT field. Many expatriates in Zambia teach ICT in schools and universities, each from the point of view of his or her own culture. Belgium contributes to the UNZA education programme through a large number of its nationals.

There is high staff turnover in the university Computer Centre; it is difficult to maintain highly skilled staff: because of the relatively small number of ICT professionals within the country, there are few opportunities for professional development and the stimulation of new ideas.

Governance
There is instability in the management of the university. The university operated for some time with its top officers in an acting capacity, causing uncertainty in decision-making processes, including those related to ICT development within the university. Fortunately this situation was resolved in 2001. The Vice-Chancellor and his deputy have received full appointments as managers of the university, and the Chancellor is once again the President of Zambia. Nevertheless, it will take time to see whether the university can create a more stable and independent decision-making environment.

Donors
UNZA had co-operation programmes in the area of ICT with Holland, Great Britain, Finland and Belgium for many years. While the other donors have ceased their support to UNZA, Belgium is still very active. From 1999 to 2001, Belgium spent a total of 27.8 million BEF. This contribution has been very substantial for UNZA and UNZA needs it to be continued.

Procedures for ICT acquisition under this co-operation have been set up independently of UNZA, which is regarded as very slow and not efficient. The management of the acquired ICT is at the level of the implementing unit. The independence of projects funded by Belgium makes it difficult to get real consolidated information on the ICT acquired from both donor and government funds. The concentration of donor funding in one country also carries an element of risk.

ICT suppliers
The two major suppliers in Zambia are IBM and Compaq/Hewlett Packard. Most vendors are IBM dealers but they do not offer after-sales services and in many cases do not offer
guarantees. The small number of vendors and poor after-sales service and support limit the scope of UNZA to acquire appropriate technology solutions and to solve problems in a timely and efficient manner.

The public sector, to which the university belongs, has no ICT policy. The national telecommunications service is a monopoly. As it has no need to compete, it introduces technological change very slowly. It still runs analogue circuits to public subscribers when most of the private sector already has digital infrastructure on site. The links to Copperbelt and Livingston from Lusaka are said to be digital. Cell phone services are available in some provinces. However, the exchange of information among provinces is still a problem and an even greater problem is the exchange of information among districts.

The telecommunications monopoly and the lack of a national information policy mean that the general atmosphere within the country is not supportive of innovation. This was one of the motives for UNZA to establish ZAMNET as a pioneer ISP in the early 1990s. After a promising start it has had difficulty maintaining momentum

Conclusions
UNZA is governed by civil service rules and is influenced in its day-to-day activities by the government. Rules external to the university tend to serve as frameworks and in general they do not take into account the specifics of the university. Its close relationship with the government means that decisions are not always within the purview of university governance; they have a political dimension and can also be delayed by bureaucratic processes, which influence negatively the implementation of the university strategy. The Government can exercise great power over the daily activities of the university.

Zambia still lacks sufficient qualified people, and this is reflected within the university and in the quality of its educational and research programmes. The low level of Zambia’s economy greatly affects the university’s functioning, in particular the implementation of the institution’s strategies.

The political environment is not favourable for foreign investment or donations. Nevertheless donors contribute greatly to funding ICT programmes, although in many cases programmes identified as important by national institutions must be reshaped to fit donor agendas. ICT acquisition, for example, is very much influenced by the interests of the donor countries or organizations. This has a negative impact on the implementation of most ICT projects because important factors such as sustainability and skills building are not taken into account. Some donors organize regular ICT promotional activities in various distant parts of the world, which results in little positive impact on national activities. The promotional activities of donors often draw resources away from national ICT objectives and disperse the small concentration of skills. This not only leads to delays in ICT implementations but also gives the few skilled staff less time to provide professional ICT services to the university.

Major brand names of European, American and Asian hardware, software and communication technologies can be found in Zambia. Although the ICT components are still in the hands of few Zambians, they are already of high diversity and distributed throughout the country, which imposes on Zambia the need to invest in the establishment of professional ICT service management.

10.6 Subjects and objects for assessment using the State Model/ Extended State Model

State Model/ Extended State Model subjects and objects
- University Network (State(s) and tasks and processes)
- Local Area Networks (State(s) and tasks and processes)
- General Information Systems

203
University Network
UNZANet was planned many years ago. Its implementation has been taking place bit-by-bit, as financial resources become available. UNZANet is handled centrally by the Computer Centre, the Internet Service Provider (Zamnet) and the telecommunications company (Zamtel).

In the Extended State Model UNZANet is in the U, M1/M2, and E States. The system consists of two servers at the Computer Centre, a high-speed fibre link connecting the campus and a 10 Mbits Ethernet inside the buildings. The linkage to remote units such as the School of Medicine and INESOR is made by wireless (radio) technology. As a result of utilization, modifications are made to introduce new hardware and software with a better performance and to establish more functionalities. Either because of poor planning or because of lack of funding, the existing UNZANet has not taken into account the nature and flow of traffic. This is demonstrated by the fact that in the Utilization State, bandwidth among campuses and for the Internet access is very limited. Demand consistently exceeds supply, which is a frustrating factor for the UNZA community. Plans are said to be underway to increase the bandwidth to the Internet.

Local Area Networks
Concerning the Local Area Networks, the Planning State has been passed for all buildings. For around 80% of the buildings, LANs have been acquired/developed and implemented. Around 1200 LAN points are available. The initial implementation covered 500 LAN points. In these buildings the LANs are in the U, M1/M2, and E States. Maintenance is carried out more often than Modifications. Finance is still lacking for acquisition/development and implementation of LANs for the remaining 20% of buildings.

General Information Systems
Personnel and Payroll Information System (PPIS)
This system is handled centrally by the Computer Centre and the central administration, and is now in the U, M1/M2, and E States. In the Utilization state the Salaries and Personnel Officers do the data entry and data amendments. The Computer Centre runs the payroll system each month. The system runs on a Compaq Proliant 3000 server, Unix operating system, NT/Server and Informix 4GL Database. As a result of utilization, maintenance, which leads to modifications, is undertaken. In this, plans are underway to connect the system to other administrative information systems, such as the Student Records Information System.

Student Records Information System (SRS)
This system is handled centrally by the Computer Centre and locally by each academic unit and each academic staff member. It is now in the U, M1/M2, and E States. In the Utilization State, the system interfaces with the admission system and student finance system and it provides the following facilities: registration, planning, examination processing, graduation and maintenance. The system runs on a Compaq Proliant 3000 server, Unix operating system, NT/Server and Informix (RDS) Database. As a result of utilization, maintenance/modifications are undertaken. In this, plans are underway to connect the system to other administrative information systems and the library system, bookshop, medical services and CS3.

Accounting Information System (Chameleon 2000, which is being replaced by CS3)
This system is handled centrally by the Computer Centre and locally by 34 academic and administrative units of the university. In the Extended State Model this system is in the U, M1/M2 and E States. In the Utilization State, financial data is entered in the 34 academic and administrative units, to be processed centrally by the Computer Centre. The system runs on a Compaq Proliant 3000 server, Unix operating system, NT/Server and Informix (RDS) Database, over a LAN. As a result of use, maintenance/modifications of the system take place. In this regard
plans are underway to connect the system to other administrative information systems, such as PPIS, SRS, and the library system.

**Library Information System**

This system is handled centrally at the Central Library and locally at remote sites throughout the university campuses. In the Extended State Model this system is in the U, M1/M2, and E States. In the Utilization State, database entry is done by the library database management staff into the integrated Library Information System, which provides students and academic staff with on-line access to worldwide information via the Internet. The number of access points and the speed of data transmission are very limited.

The system is a PC-based library management system (Dynix Library Database Management system on a Windows NT Server). As a result of use, maintenance/modifications of the system take place. In this regard, plans are underway to replace outdated computers and to connect the system to administrative information systems, such as the bookshop and CS3.

**Student Records Information System at Directorate for Distance Education**

This system is still in the design phase. It will be centrally run at the Directorate of Distance Education (DDE) and remotely run at the seven provincial centres. The system is expected to operate interfacing with UNZANET. At the moment no written plans of how to achieve this are available. The Computer Centre is not involved. DDE intends to execute all management functions.

### Conclusions

UNZANet constitutes a centrally planned, developed/acquired, implemented and managed ICT infrastructure. Modifications are taking place to accommodate new technologies, to improve existing ones and to provide more Internet access points. The majority of planned LANs in different buildings of UNZA have been implemented and they are in use.

Administrative software applications at UNZA have been physically established at the university Computer Centre and users of these applications, such as the finance and human resources staff, are dependent on the Computer Centre to access computing facilities. For the established information systems, utilization takes place while new functionalities are being introduced both by the user departments and Computer Centre staff. The combination of the two states creates an opportunity for conflicts between users and the developers, and creates lack of confidence on the part of users.

Because of the lack of human and financial resources, most of the planned general information systems have not been acquired/developed.

### 10.7 Subjects and objects for assessment using the Three Kinds of MCM Model and the Expansion of the Three Kinds of MCM Model

#### 10.7.1 Functional Management (FM)

**Organization**

Functional Management tasks at UNZA are mainly undertaken by the CC, and also by some Schools and administrative units. The university top management and the external ICT services suppliers are also involved in some FM. The decentralization processes implemented within university include the decentralization of ICT, and therefore Functional Management is performed in university units owning ICT. Users perform Functional Management with support of the staff of the CC and ICT suppliers. Tasks related to FM, however, are not fully implemented.
Chapter 10 – Assessing the University of Zambia (UNZA) - Zambia

Tasks
Table 10.7.1 provides an overview of tasks undertaken by the different parties involved in FM tasks. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

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<tr>
<th>Task Areas/ Task Fields</th>
<th>University Computer Centre (CC)</th>
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<td>• Functional Maintenance of Information Systems</td>
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<td>• Data Definition Control</td>
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Table 10.7.1 - Functional Management tasks undertaken by the different parties at UNZA.

Processes
Processes related to FM are mainly undertaken by the CC. Such processes were presented in Section 10.3, where the entity MCM was presented.

Procedures
Procedures for the realization of tasks are occasionally formulated and written down. The implementation of procedures is ad-hoc based and they are not rigorously followed and controlled.

People
Number: 50 people are involved in FM
Education: Around 20% have university degree and have actually followed ICT courses.
Experience: Most of the staff involved in FM have more than five years of working experience.
Personnel turnover: University staff involved in FM often find new jobs and tend to leave the university.

10.7.2 Application Management (AM)

Organization
The units involved in the AM tasks are the CC, administrative units, and ICT service suppliers. Application management is performed mainly by users, but also by staff of software application suppliers, usually from outside Zambia.

Tasks
Table 10.7.2 provides an overview of tasks undertaken by the different parties involved in AM tasks. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

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<tr>
<th>Task Areas/Task Fields</th>
<th>University Computer Centre (CC)</th>
<th>Faculties and Administrative Units</th>
<th>External ICT Service Suppliers</th>
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Table 10.7.2 - Application Management tasks undertaken by different parties at UNZA

Processes
Processes related to AM are mainly undertaken by the CC. Such processes were presented in Section 10.3, where the entity MCM was presented.

Procedures
Procedures for the realization of AM are not normally in written form. Where they are, they are not rigidly followed.

People
Number: Around 40 people are involved in AM
Education: 20% of staff involved in AM have a university degree. 80% of staff involved in AM have followed some sort of ICT course.
Experience: Most of the staff involved in AM have more than five years of working experience.  
Personnel turnover: In general university staff involved in AM can easily find paid jobs outside university and they tend to leave the university.

10.7.3 Technical Management (TM)

Organization
Technical Management is performed in more than one unit within the university. External ICT service suppliers and consultants also perform TM. The following units are involved in TM: the CC, the university computer labs belonging to some units such as School of Engineering, School of Natural Sciences and Directorate of Distance Education. In the Schools, basic TM tasks are realized but complex TM tasks are performed by the CC or external ICT service suppliers. The university top management is also involved in some TM.

Tasks
Table 10.7.3 provides an overview of tasks undertaken by the different parties involved in common TM tasks. The mark (✓) indicates that tasks are more or less performed, usually at a low level in terms of the generally accepted quality standards.

Processes
Processes related to TM are mainly undertaken by the CC. These processes were presented in Section 10.3, where the entity MCM was presented.

Procedures
Procedures for realization of TM tasks are not rigorously applied or realized

People
Number: The University has 30 staff members involved in realization of TM tasks.  
Education: Around 30% of the staff members involved in TM have followed advanced ICT courses.  
Experience: Around 20 of the university staff have more than 5 years of working experience in TM.  
Personnel turnover: Staff involved in TM easily find better-paid jobs outside the university and as soon an opportunity occurs they tend to leave the university.
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<thead>
<tr>
<th>Task Areas/ Task Fields</th>
<th>University Computer Centre (CC)</th>
<th>Faculties and Administrative Units</th>
<th>External ICT Service Suppliers</th>
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<td>• Information Supply</td>
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Table 10.7.3 - Technical Management tasks undertaken by the different parties at UNZA

**Conclusions**

Although not recognized as such, the Three Kinds of MCM are realized in one way or another within the university. Processes and tasks to be performed under the Three Kinds of MCM are known, but are not followed completely because they are not fully understood. In all three kinds of MCM the CC plays a major role. Realization of Tasks and Processes is not formalized but takes place on an ad-hoc basis. For the amount of ICT available there is a shortage of skilled staff within the university to undertake the Three Kinds of MCM. The few available skilled staff have acquired ICT management knowledge through on-the-job training or through short courses. Qualified staff tend to leave the university, however, for better-paid jobs.
Chapter 10 – Assessing the University of Zambia (UNZA) - Zambia

The education system in Zambia does not offer ICT management courses which could develop skills for different types of management.

10.8 Drawing conclusions for the Big ICT Five

For the overall assessment of UNZA, we formulate the following conclusions in relation to ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization, and ICT service management:

Concerning ICT - strategy
As there is no formalized strategy with respect to ICT as an integrated component of education and administration at UNZA, decisions on ICT issues are made in an ad hoc way, based on situational factors. UNZA has developed its Strategic Plan, which includes major statements on what the university expects from ICT. These expectations must now be translated into strategic objectives for ICT, and the means to achieve them must be specified, taking into account their implications and the constraints within which they must operate. It is not clear how this can be achieved given the limited amount of staff and financial resources available.

Concerning ICT – development/acquisition
UNZA has a complex process of ICT acquisition. This process is more dependent on the source of financing of ICT than on the need for harmonized procedures. Units within the university with financial resources can acquire their own ICT. The benefits to be gained from common approaches to acquisitions are not widely recognized nor easily accepted within the university.

For historical reasons the university itself developed some of its administrative information systems. UNZA needs to establish a new strategy in relation to which systems need to be developed in-house and which will be obtained off-the-shelf from ICT vendors, taking into account the limited internal technical capacity.

Given the limited financial resources available there is competition for funding and it is difficult to enforce systematic acquisition procedures under the supervision of the Computer Centre.

Concerning ICT - implementation
Implementation of ICT is shared between the Computer Centre, the beneficiary user units, and the external service suppliers. Sometimes the division of tasks is not clear and the Computer Centre is left with the main responsibility. ICT implementations neglect formal processes, as there is no application of a project management oriented approach or prior definition of service level agreements with ICT service suppliers. This makes it difficult to monitor the performance of the implemented systems and to ensure maximum benefit from scarce resources for systems support. In the absence of good system documentation it can also complicate support and troubleshooting.

Concerning ICT - utilization
The utilization of ICT is mainly PC-based and has grown significantly within UNZA in recent years. Most academic staff and students now use ICT to support their activities.

As UNZANET grows, its complexity also grows along with the number of systems attached to it and the demand for services. Unfortunately such developments are not accompanied by the development of the skilled human resources needed for correct utilization of the available ICT. UNZA has not properly addressed the issue of a human resources development plan for better use of ICT, nor training programmes for users, technicians and managers of ICT. Neither has UNZA addressed other relevant strategic subjects such as making all the users aware of all costs involved in the implemented ICT, as well as aspects of ICT security.
Concerning ICT - service management

ICT service management is mainly centralized at the CC although some units such as Engineering, Natural Sciences and the Directorate of Distance Education attempt to support their own ICT up to certain level. There are no formal procedures for support to utilization of ICT between the CC, Schools and administrative units. Responsibilities for ICT service delivery, user groups relationships, and management of ICT costs are not clearly established. Relationships between the university and ICT service suppliers such as the Computer Centre and Zamnet are on an ad hoc basis. Service levels required by the university have not been defined. Services offered by Zamnet, for example, are very poor.

The role of the Computer Centre, in terms of its organizational structure, its positioning within the university, the staffing and financing of its activities, its business plan and the provision of services outside the university, needs to be examined in order to transform the Centre into a professional ICT service unit and to avoid competition between the CC and other UNZA units offering ICT services.
11. THE CONCEPTUAL MODEL

11.1 Introduction

The intensive and very detailed assessments of the six universities produced a lot of information on the status of and approach to the accomplishment of the five subjects of the Big ICT Five. The conclusions of the assessments clearly demonstrate three situations concerning the ICT objects and subjects assessed:

- Firstly: ICT is a well-known object at the universities. Advanced ICT is available at many locations. Over the years, wide university networks have been implemented and are in use by many staff members and students. Education in ICT takes place. Staff members, of all levels, are able to participate in conferences, workshops and management meetings on ICT, both within and outside their university. Access to the Internet offers possibilities to communicate with people in all parts of the world. Thus, a variety of ICT objects and subjects are already being given attention, or play a role, in the planning, application, utilization and the management of ICT.

- Secondly: Many ICT subjects are not thoroughly understood by the university management. On the operational level there is considerable freedom to implement, to change and to support the utilization of ICT. In general there is a weak relationship between top management and the computer centre management. That people have knowledge of the subjects does not necessarily lead to a well-defined implementation – more often than not a fragmentary approach is used, based on pure individual insight, rather than professional strategies, rules, procedures, skills and experience.

- Thirdly: The importance of ICT in education, research, administration, services and management is fully endorsed. The need for a professional service that thoroughly oversees ICT objects and subjects is clearly perceived. Management, at the strategic, tactical and operational levels, understands that integration and good relationships must take the place of fragmentation.

On the basis of these three situations we have identified the need to design a conceptual model to serve as a tool for supporting the understanding and the application of the subjects ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization, and ICT service management. In order to be effective, this tool must help those who have responsibilities concerning one or more of the ICT management subjects. The model must deliver information in such a way that it helps them to understand the significance and the content of a number of relevant subjects, whilst also providing indications of how to accomplish these subjects. In other words, the model includes descriptions of WHAT must be understood and directives on WHAT should be implemented and HOW.

The model is designed by means of a step-by-step approach including the following steps:

Step 1 Structuring the Big ICT Five Model in such a way that it reflects the logical mutual relationships between the five subjects in practice.

Step 2 Justifying the splitting of each main subject into five sub-subjects.

Step 3 Showing the main subjects and, for each, their five sub-subjects in a diagram which is the basis for the next two steps.

Step 4 Describing each main subject by means of a definition; a brief description (WHAT is it?); and a prescription for its accomplishment, by means of main directives (WHAT to do and HOW to do it); followed by literature references.
Step 5  Describing, for each main subject, the five sub-subjects by means of a definition, a brief description (WHAT it is), and a prescription for their accomplishment, by means of directives (WHAT to do and HOW to do it).

11.2  Step 1 - Structuring the Big ICT Five Model in such a way that it reflects the logical mutual relationships between the five subjects in practice

The main objective of this step is to structure the Big ICT Five in a way that reflects their logical mutual inter-relations in practice.

![Diagram](image)

Figure 11.2.1 - Preliminary design of the Big ICT Five Model

The starting point of the Big ICT Five Model is the ICT strategy, including a vision and plans regarding the role of ICT in education, research, administration, services and management. This is followed by development and/or acquisition of ICT, with the application of project management procedures. As soon as the results of development/acquisition are tested and accepted, ICT implementation follows. This includes all activities that have to be carried out to prepare for ICT utilization and ICT service management. The relationship between these last two main subjects is that ICT utilization is supported by ICT service management, and that ICT service management is undertaken according to the requirements and preconditions defined by ICT utilization.

New requirements and preconditions (set by ICT utilization, new or renewed ICT, or the need to add to or change ICT services) cause a return to the subjects ICT strategy and/or ICT development/acquisition. From here the sequence of situations presented before will be repeated. A return to ICT development/acquisition is expected to be more frequent than a return to ICT strategy, which will only occur as a consequence of a change in the overall strategy of the university, or external influences. For example, in its ICT strategy a university may give priority to providing e-mail for all staff and students. As soon as this strategic decision is made, the university may acquire an e-mail package, such as Pegasus, off-the-shelf. After acquisition, implementation will take place, followed by utilization and, from time to time, servicing. A newer version of Pegasus may be made available by the supplier, leading to replacement of the previous version. This will force a new acquisition process, followed by implementation, utilization and servicing. The frequency with which acquisition takes place depends on changes in requirements and technology, but the strategic decision to provide e-mail remains the same.

The five main subjects and their mutual relationships are presented in Figure 11.1.

In relation to this outline model, we put the question: ‘What is the content of the five main subjects which represent the Big ICT Five?’ Before answering this question, in Section 11.3
we review a number of issues derived from the conclusions of these assessments. This will help us to identify those sub-subjects, which are most relevant to the question.

11.3 Step 2: Justifying the splitting of each main subject into five sub-subjects

The main objective of this step is to justify the definition of five sub-subjects for each main subject.

The six university assessments delivered a lot of information concerning ICT. There were positive observations as well as many observations of shortcomings in the way the Big ICT Five are realized and accomplished.

Without repeating all the conclusions that have been stated previously, a few conclusions for each main subject will be emphasized, in order to focus specifically the most important subjects which are essential for desirable and practical ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT service management. These conclusions are:

- In general, strategic plans are very detailed documents that include a mixture of non-ICT and ICT subjects, but do not detail concrete plans and bases for projects for the realization of ICT.

- Decisions on development of software and acquisition of software and hardware products are mostly made locally. Formal directives in relation to the advantages and disadvantages of development or acquisition are missing. Decisions made within the universities and by outside donors both play an explicit role in the selection process with respect to ICT development or ICT acquisition.

- In practice, ICT implementation is focused on ICT utilization, rather than on a balance between ICT utilization and an ICT service management that is immediately able to support ICT utilization after ICT implementation is completed. A well-defined and well-performed project management that supervises all issues and is an integral part of implementation of ICT is lacking.

- An effective and efficient use of ICT needs a good understanding of that ICT. In this respect, education programmes are indispensable. These must contain correct education on different levels of ICT utilization and must be balanced in order to serve all staff members, rather than always the same few. There is often little understanding of the rights and duties of ICT utilization, or these are defined in a one-sided way in service level agreements (SLAs) prepared by technically-oriented people involved in ICT service management. Users are not charged for ICT utilization by ICT service management responsible for support.

- With reference to a transformed Capability Maturity Model of management, control and maintenance of information systems [Looijen 1998, Supplement], ICT service management operates at the lowest level. One main characteristic of current ICT service management is that it is event-driven. In some cases ICT service management performs activities at the request of external organisations. These organisations have to pay for ICT services, whilst the universities do not. The role of ICT service management in education and research is either missing, or only weakly integrated in the core business of the universities.

All these conclusions demonstrate that the Big ICT Five encompasses many different subjects. In order to build awareness and obtain an understanding of the five main subjects, for each of these we identify five sub-subjects related to the conclusions set out above. Together the sub-subjects represent the broad scope of the Big ICT Five and focus mainly on
those aspects of ICT which were found to be unknown or neglected, or had an unsatisfactory qualification.

In relation to ICT strategy we identify and distinguish between the following five sub-subjects:

- **education and research**
  This sub-subject draws attention to the necessity to integrate ICT in curricula and research projects, which are an essential part of the core business. This approach goes beyond simply using PCs and having access to the Internet.

- **management and administration**
  This sub-subject draws attention to choosing and implementing broad university information systems to support financial, personnel and student administration. Aspects such as interrelationships between systems, internal development versus external acquisition and ownership are integral to this sub-subject.

- **general services**
  This sub-subject draws attention to automated library systems in relation to state-of-the-art technologies such as CD-ROMs, virtual library systems and access to the Internet. Another important service is ICT service management, including issues such as centralization and/or decentralization, recovery after disaster and charging for services.

- **security**
  This sub-subject draws attention to the policy aspects related to the security of persons and physical objects, the security of hardware, software, data and communication facilities, and the issue of privacy.

- **investments and costs**
  This sub-subject draws attention to investments and costs (capital costs and running costs), as being the consequences of planning, implementing and renewing ICT in different parts and locations of the university.

In relation to ICT development/acquisition we distinguish the following five sub-subjects:

- **development versus acquisition**
  This sub-subject draws attention to the comparative benefits and disadvantages of software development and software acquisition.

- **requirements and preconditions**
  This sub-subject draws attention to the specification of requirements concerning development/ acquisition of ICT and/or implemented ICT. Requirements and preconditions must be known. To ensure that they can be honoured, the definition of requirements and specifications must take account of their financial, personnel and technical implications.

- **development process**
  This sub-subject draws attention to all issues related to the development of ICT. Project management that covers all objects and subjects that are inherent in creating ICT, such as information systems and communication networks, is essential.

- **acquisition process**
  This sub-subject draws attention to all issues related to the acquisition of hardware, software and communication facilities. As in the sub-subject ‘development process’, project management is also essential in ICT acquisition.
• **selection process**  
This sub-subject draws attention to methods which support the selection of ICT suppliers and ICT products on the basis of a number of criteria and weighting factors.

In relation to ICT implementation we distinguish the following five sub-subjects:

• **project management**  
This sub-subject draws attention to the need for the management of ICT projects to accord with up-to-date and state-of-the-art approaches to avoid ad hoc and personally oriented approaches.

• **end-user training**  
This sub-subject draws attention to the need for training users of ICT, in order to gain maximum benefits from the implemented ICT.

• **management, control and maintenance training**  
This sub-subject draws attention to the need for training staff members who are involved in management, control and maintenance of implemented ICT.

• **service level agreements**  
This sub-subject draws attention to the definition and compilation of service levels required by ICT users, and the provision and management of these levels through ICT service management.

• **testing**  
This sub-subject draws attention to verification and validation of ICT products and to ensuring that ICT users and ICT service management are able, respectively, to use and to service the developed/acquired and implemented ICT.

In relation to ICT utilization we distinguish the following five sub-subjects:

• **effectiveness and efficiency**  
This sub-subject draws attention to the application of ICT in business processes in an effective and efficient way.

• **user skills**  
This sub-subject draws attention to the skills needed for using ICT, taking into account the various changes taking place in ICT.

• **management, control and maintenance relationships**  
This sub-subject draws attention to the interaction between users and those who are responsible for the management, control and maintenance of the available ICT.

• **security awareness**  
This sub-subject draws attention to the organisational and technical aspects of security which ICT users should understand and take care of.

• **cost awareness**  
This sub-subject draws attention to the costs which are related to ICT development, ICT acquisition, ICT utilization and ICT service management.

In relation to ICT service management we distinguish the following five sub-subjects:
three kinds of management, control and maintenance
This sub-subject draws attention to functional management, application management and technical management - three kinds of management, each with its own responsibilities and mutual relationships.

service support subjects
This sub-subject draws attention to the service support processes: incident management, problem management, configuration management, change management and release management.

service delivery subjects
This sub-subject draws attention to the service delivery processes: service level management, financial management, capacity management, continuity management and availability management.

user relationships
This sub-subject draws attention to user support, consultation, participation in user groups and reactions and comment from users.

charging
This sub-subject draws attention to charging for the services delivered to internal as well as to external individuals and units.

11.4 Step 3: Showing the main subjects and, for each, their five sub-subjects in a diagram which is the basis for the next two steps

This step shows, by means of a diagram, the structure of the main subjects and the sub-subjects. Each main subject consists of four blocks (see Figure 11.2):

- the definition block
  This block contains a concise formulation of the main subject

- the description block
  This block contains a brief description of the main subject, in order to create awareness and understanding about a number of essential issues. It answers the question 'what is it, what does it mean?'

- the prescription block
  This block contains indications and directives concerning the implementation of the main subject or parts of it. It answers the question 'how should the main subject be accomplished?'

- the reference block
  This block contains a limited number of literature references, providing a signpost to other relevant literature which can give useful information about the main subject. This literature also contains information about the sub-subjects that belong to the main subject.

The blocks are shown in Figure 11.2. and are elaborated in step 4.

Each sub-subject consists of three blocks (see Figure 11.2):

- the definition block
  This block contains a concise formulation of the sub-subject.
Figure 11.4.1 - Main subject and sub-subject structure of the Big ICT Five
Chapter 11 – The Conceptual Model

- the description block
  This block contains a brief description of the sub-subject to create awareness and understanding of the sub-subject. It answers the question ‘what is it, what does it mean?’

- the prescription block
  This block contains indications and directives concerning the implementation of the sub-subject or part of it. It answers the question ‘how should the sub-subject be accomplished?’

The blocks are shown in Figure 11.2 and are elaborated in step 5.

The structure shown in Figure 11.1 and the diagram shown in Figure 11.2 are the basic structures for the development of the automated tool worked out in Chapter 12.

11.5 Step 4: Describing each main subject by means of a definition; a brief description (WHAT IS IT?); and a prescription for its accomplishment, by means of main directives (WHAT to do and HOW to do it); followed by literature references

This step focuses on the five main subjects. Each main subject is defined. The definition is brief and unambiguous and is followed by a more detailed description. The description is meant to provide information about issues that belong irrefutably to the main subject. It clarifies the question: ‘What is the meaning of the main subject?’ The description is followed by a prescription, consisting of directives on how to accomplish the main subject or part of it. Finally, some literature references are given, together with a few brief informative passages that explicitly or implicitly refer to the main subject and its respective sub-subjects. These passages are necessarily limited for practical reasons and are not intended to cover the huge volume of literature on the subject that is available and accessible via the Internet and virtual libraries.

11.5.1 ICT Strategy

Definition
ICT Strategy includes a vision of the application of ICT to education, research, management, administration and services and how this vision is to be achieved, considering the personnel, technical and financial means which are available.

Description
It is hardly possible to undertake a survey of the ICT market. A huge range of products, hardware, software and communication facilities, continually appear and disappear. The same happens with suppliers of all these products. Once implemented, utilized and managed, ICT is liable to frequent modification and replacement. Without any strategy these situations are likely to influence and even dictate the development, acquisition, implementation, utilization and management, control and maintenance of ICT at random, in a more or less chaotic way; the goal becomes not the realization of an effective and efficient ICT application but merely to have ICT available. In order to avoid this unacceptable situation the top management of the university must establish clear indications with respect to the application of ICT in all areas of the university and at all levels. These indications or directives are part of the top management’s strategic responsibilities.

The strategy comprises all relevant issues concerning the application of ICT in the core business (education and research) of the university and the support (management, administration and services) to that core business. At the same time the ICT strategy includes issues such as needs in terms of personnel, objects and subjects related to ICT, and how to satisfy these needs. The necessary financial means and how to obtain them must also be
considered, including investments and running costs, and taking due account of the costs of maintenance, replacement and educational and training needs.

A well-categorized overview, including definition of priorities and planning for the next 3-5 years, must be undertaken in order to determine the strategic issues, and their number. The dynamic and still young ICT world may at all times exert an influence on the ICT strategy, and care must be taken to verify the real need to modify and supplement the ICT strategy, once accepted. Frequent changes will affect the credibility of the accepted ICT strategy over the following years. It is the task and the responsibility of the top management of the university to superintend and to guarantee the establishment of a state-of-the-art ICT strategy.

**Prescription**

Prescription provides directives on how to develop an ICT strategy or parts of it. This prescription emphasizes a logical and structured approach. It indicates the questions to be answered, without creating a complete ICT strategy document, which is beyond the scope of this research. Nevertheless, five sub-subjects belonging to this main subject will be defined and described, and provided with prescriptions for their accomplishment. As mentioned before, they cover the essential aspects of the ICT strategy.

The questions to be answered regarding the development of an ICT strategy are the following:

- WHAT are the strategic issues that have to be developed and HOW should they be formulated?
- WHY do these issues have to be developed?
- WHO has to be involved in the development of these issues and WHAT kinds of proficiency are needed?
- HOW does the development of these issues take place?
- WHEN does the development have to start?
- HOW should progress be controlled (overseen)?
- WHEN does the development have to finish?

In other words, the correct ICT strategic issues must be selected and defined, and their selection justified. The right people must be assigned to the development, taking into account their proficiency and the time needed for the work. The development methodology must be formulated, including steps, time aspects and intermediate deliveries. The starting date, how to measure progress and the finishing date must be determined.

**Literature references**

The huge number of books and articles about ICT strategy offer unlimited information to those who are responsible for the development and supervision of strategic issues. This does not mean that they provide a great variety of information, nor information very useful for answering the aforementioned questions. It is therefore decided to refer to only two books as examples for formulating, organizing, developing and managing ICT strategy. These books are:

- **Management Strategies for Information Technology** by Michael J. Earl [1998]. This book focuses on the IT-period, information management, IT and strategic benefits, formulating IT-strategy and information management strategy, organizing IT activities, managing IT activities and strategic changes.
- **Managing IT as a Strategic Resource** by Leslie P. Wilcock et al [1997]. This book focuses on the functions of the chief executive, managing strategic technology projects, sourcing IT, emerging IT and key trends in ICT capabilities and learning.
11.5.2 ICT Development/Acquisition

Definition
ICT development/acquisition comprises the development of ICT and the acquisition of ICT as well as the differences between these approaches in terms of benefits and disadvantages.

Description
The development and/or the acquisition of ICT is a consequence of the ICT strategy, and therefore includes a vast array of activities. Over the years, the needs for ICT and the supply of ICT have increased continuously. Investments, and how they are obtained, play an important role. On the one hand they are needed to finance the development activities or the acquisition, and on the other hand they are needed for maintenance and additions and changes to already implemented ICT.

In-house ICT developments must be critically considered and compared with the available ICT offered by numerous suppliers. A professional comparison must therefore be made between the benefits and disadvantages of ICT development and of ICT acquisition. For this reason five essential sub-subjects have been defined.

Prescription
Before any decision is made to develop or acquire ICT the following questions have to be answered.

- WHAT are the arguments for acquiring/developing new or modified ICT?
- WHAT kind of ICT fulfils the requirements?
- WHAT are the benefits and disadvantages of undertaking in-house ICT development?
- WHAT are the benefits and disadvantages of acquiring ICT from elsewhere?
- WHAT resources are available, in terms of personnel, finance and proficiency?

As soon as the need for ICT and the approach to development or acquisition are clarified, preconditions must be defined for fulfilment of the process of ICT development or acquisition. These preconditions include the available financial means, human resources (internal/external) and time limits.

In other words, it must be made clear why new or modified ICT is needed, taking into account the ICT strategy, the ICT which is already implemented and the ICT trends. The differences between ICT development and ICT acquisition must be clearly understood by studying their respective benefits and disadvantages. Based on the outcome, all relevant preconditions must be formulated, taking into account the available resources.

The answers to the questions and the formulated preconditions are the basis for a development or acquisition process that will meet the needs for ICT. For a definition, description and prescription of the acquisition and development processes, please refer to the sub-subjects in Section 11.6.2.

Literature references
The number of publications concerning the development of ICT (mostly in terms of information systems) is tremendous. Alongside the traditional programming languages and methods, internet technologies have introduced their own programming facilities. From this array of references, we recommend the following:

- Object-Oriented Analysis and Design with Applications by Grady Booch [1994]. This book focuses on modelling concepts such as object modelling, advanced object modelling, dynamic modelling and functional modelling, and design methodology, including methodology preview, analysis, system design and object design.
Chapter 11 – The Conceptual Model

- The Unified Modeling Language User Guide by Grady Booch et al [1998]. This book describes UML, which has rapidly been accepted throughout the software industry for specifying, visualizing and documenting software-intensive systems.

11.5.3 ICT Implementation

Definition
ICT implementation comprises the validation of the results of the development or acquisition process, and installation and customization for operations for the benefit of utilization and service management.

Description
Bridging the gap between having available ICT resulting from an ICT development or acquisition process and the utilization and management of that ICT demands a well-considered process called ICT implementation. It is not acceptable to bridge this gap without paying professional attention to the implementation issues. The steps which have to be followed between the ICT being available and the ICT being effectively and efficiently applied and supported must not be underestimated.

After development or acquisition it is worthwhile to pay attention to validation, i.e. to checking whether the ICT actually behaves as expected. It should be noted that validation is context-dependent while verification is not. To prevent misunderstanding we define verification as checking whether the results of development or acquisition are free from logical errors. Because of differences in situational factors, installation must be coupled with customization to adapt the ICT to the specific local conditions of utilization and service management.

Prescription
ICT implementation starts with answering the following questions:
- WHAT has to be implemented?
- WHO needs the implementation?
- WHO carries out the implementation?

After answering these questions, one needs to find out whether the users and those responsible for service management are aware of the implementation process and are equipped with the necessary proficiency. All will be participants in this process and all must fully understand that implementation is formed by a triangle whose angular points are: those who are able to implement because of their technical know-how, those who are the future users, and those who will be responsible for the delivery of services or service management. The whole implementation process has to be carried out using professional project management procedures, for example PRINCE2.

Literature references
ICT projects are becoming more and more complex because of the variety, heterogeneity and sophistication of the ICT as well as the involvement of many different disciplines. Moreover, multiple preconditions with regard to finance, human resources and time restrictions are predominant issues of ICT projects. Undertaking ICT projects on the basis of practical experience alone without the use of methods and techniques must be avoided. It is strongly recommended that proven methods and techniques should be applied to support the management of ICT projects, in this case ICT implementation. Therefore we refer to the following publication:

- Managing Successful Projects by CCTA [2002]. This book, which is very comprehensive, covers all the issues to be addressed in the successful management of large and complex projects. It starts by emphasizing the need for using a project management method. Following this, a wide framework for project implementation is presented.
Chapter 11 – The Conceptual Model

- Small projects do not require such a comprehensive approach, and the counterpart of this publication, The Little PRINCE2 by CCTA [date], is recommended.

11.5.4 ICT Utilization

Definition
ICT utilization comprises all issues which must be addressed in order to achieve an effective and efficient use of ICT, fully integrated into the university core business and support activities.

Description
ICT utilization is becoming a more and more common activity. PCs are playing a role in education and research and are indispensable facilities to support management, administrative and service-oriented tasks. Access to the Internet is another example of ICT utilization. In all cases it is important to pay attention to the frequently mentioned characteristics of effectiveness and efficiency. Effectiveness is the capability to correspond to the expectations for defined functions, while efficiency is the capability to provide the desired information at acceptable costs. Meeting these characteristics fully demands programmes for teaching or instructing ICT users. The content of these programmes depends on the functions and tasks of the user. It is important to understand the relationship between ICT and the university’s business: education, research, management, administration and services. The kind of business and the kind of ICT determine ICT utilization and the user requirements regarding ICT service management. This leads to the need for service level agreements (SLAs). SLAs set out the rights and the duties of the ICT users as well as of the organisation responsible for supporting the ICT users. In SLAs, cost awareness and security awareness must be given high priority. For this reason specific sub-subjects are defined in Section 11.6.4.

Prescription
Before setting up programmes to assist users in understanding how to work with ICT and the significance of effectiveness and efficiency, one should address the following questions:
- WHO are the ICT users?
- WHAT distinction/discrimination/differentiation/diversity is there amongst the ICT?
- WHAT types of proficiency are available?
- WHAT is needed to use the available ICT in accordance with the defined requirements and preconditions?

These questions form a questionnaire for assessment of the user community. On the basis of the results, activities have to be developed so that ICT utilization is brought to and maintained at the correct level. Section 11.6.4 elaborates further on the subject of ICT utilization.

Literature references
None found

11.5.5 ICT Service Management

Definition
ICT service management comprises the organizational structures, processes and proficiencies needed to deliver services in accordance with the ICT strategy and the requirements of ICT utilization.

Description
ICT service management entails delivering services in the most effective and efficient way, in accordance with the requirements and preconditions imposed by ICT utilization, current situational factors and characteristics of the ICT, in order to influence the goals of the organization in a positive way. Synonymous with ICT service management is management,
control and maintenance of information systems as well as service level management, emphasising defined service level agreements.

ICT service management distinguishes three kinds of organization because of the three basic components of ICT, namely technology, functionality and application. It comprises a number of processes for delivery of the required service, such as incident management, problem management, change management, configuration management and release management. More processes are referred to in the sub-subjects.

Interaction with ICT utilization is a main issue for ICT service management. This has to be formalized by defining service level agreements. Formerly (and it still happens) ICT service management was not charged for, all services were free. This situation is becoming more and more unacceptable, as indicated in one of the sub-subjects (see 11.6.5.5).

Prescription
ICT service management must be well organized and must be carried out according to the definition and description mentioned above. The existing ICT service management neglects many issues. Deciding whether to maintain the present level of service management or to improve it requires identification and knowledge of the missing aspects. These aspects need to be qualified, through assessment of the current ICT service management. This should be done by addressing the following questions:

- HOW is ICT service management organized?
- WHAT processes are implemented?
- WHAT types of proficiency are available?
- WHAT is the level of complexity of the ICT?

The outcome of the assessment has to be qualified using a framework which includes all the organizational components, processes and human resources which are inherent in a state-of-the-art ICT service management. One state-of-the-art method to support such an assessment is the Capability Maturity Model (CMM). The qualification of the present situation may either lead to the decision to continue the present ICT service management or to the definition in the future of a new ICT service management. A new ICT service management has to be developed via a transformation process using project management techniques. It must be understood that the newly formulated ICT service management does not need to represent the most ideal situation. A step by step approach to reach that ideal situation is rather to be recommended.

Literature references
Before 1990, literature on ICT management or ICT management, control and maintenance was rare. The first books were published in the Netherlands, followed by the UK. At present several books are available and numerous articles focus on a great number of issues all concerned with the wide scope of ICT service management. We mention a few books and articles which are widely distributed in the Netherlands and elsewhere.

- Information Systems Management, Control and Maintenance [1998], plus Supplement, by M. Looijen. This book, as a textbook, covers the varied and broad area of ICT service management. The basic text is composed of models which illustrate essential ICT management objects and subjects. The main goal of these models is to assist understanding and assessment of ICT management in practice.

- The Guide to IT Service Management, edited by Jan van Bon, Volume 1 [2002]. The contents of this guide include models for managing information systems, sourcing and procurement, metrics, maturity, processes, organizational aspects, practical guidance, e-management and tools and instruments. Contributions from many authors cover numerous subjects.
Chapter 11 – The Conceptual Model

11.6 Step 5: Describing, for each main subject, the five sub-subjects by means of a definition, a brief description (WHAT it is), and a prescription for their accomplishment, by means of directives (WHAT to do and HOW to do it).

This step focuses for each main subject on the five respective sub-subjects. The focus for each sub-subject includes a definition, which is brief and, as far as possible, unambiguous. This is followed by a more detailed description which provides information about issues which belong irrefutably to the sub-subject. It clarifies the question ‘what is the meaning of the sub-subject?’ The description is followed by a prescription which provides directives for how to accomplish the sub-subject.

The conceptions ‘definition’, ‘description’ and ‘prescription’ have to be interpreted not as absolute but as indicative. Definition must be read as a formulation, description as descriptive and prescription as prescriptive.

11.6.1 ICT Strategy

In relation to ICT strategy we focus on the following five sub-subjects.

11.6.1.1 Education and Research

Definition
As part of ICT strategy, the sub-subject ‘education and research’ concerns the role of ICT as an object to support education and research and as an object of education and research.

Description
The role of ICT in education and research depends on the nature of the faculty or department. If the faculty/department deals with computer science or computer engineering, or information technology or informatics (more or less synonyms for one discipline), many ICT subjects will be part of the curriculum. Such a faculty/department may be defined in the ICT strategy as a service faculty / department for teaching ICT subjects in other not specifically ICT-oriented faculties and departments which need to use ICT as a means to support their education and research subjects. Even where this kind of service provision is not part of the ICT strategy, the other faculties and departments will need ICT teaching tailor-made for their own objectives. Part of the purpose of the ICT strategy is to formulate very clearly what ICT means and what its implications are in relation to education and research, taking into account its variety.

Prescription
Prescription includes the directives which position education and research in relation to ICT in the total ICT strategy:

- Those responsible for defining the ICT strategy must be aware of and take account of the mission of the university as a whole.
- The objectives of the faculties and departments must also be derived from the mission of the university as a whole.
- On the basis of these objectives, the contents of study programmes in the area of ICT must be defined and described in detail, with clear indications of the levels to be achieved.
- The contents of the study programmes must take account of the demands of the labour market. The labour market prospects for graduates must be set out in each course programme, together with mechanisms for relationships with potential employers.

The objectives may also show how the study programmes relate to comparable university curricula in their own and other countries. The education profile will reflect the relationship with academic research in the relevant field in general, and with the research being done at
the university itself in particular. The objectives have to be operationalised through a realistic ICT curriculum and the appropriate positioning of ICT in research.

11.6.1.2 Management and Administration

Definition
As part of ICT strategy, the sub-subject ‘management and administration’ concerns the role of ICT in supporting management and administration processes. This support requires clarity, especially with regard to choices between in-house development or external acquisition and standardization.

Description
The role of ICT in management and administration is to support management and administration, such as student administration, financial administration and personnel administration, effectively and efficiently. A huge number of ICT products are available on the ICT market, as well as knowledge and facilities to develop tailor-made products. An ICT strategy must be clear with regard to the authorization of in-house development or the obligation to acquire software and information systems from the market. A strategy must also be clear with respect to standardization, to avoid a wide range of non-standardized products that require a diversity of knowledge and finance for their maintenance.

Prescription
Prescription includes the directives which position management and administration in relation to ICT in the total ICT strategy:

- Those who design ICT strategy must state clearly what management and administration has to be supported by ICT.
- In the case of existing ICT, those who design the ICT strategy must state clearly what kinds of changes have to be made.
- Priorities must be stated in the strategy, defining what has to be done as soon as possible and what can be done later on.
- Statements of policy and norms must be formulated concerning the university’s own development of ICT and/or acquisitions from suppliers, and what kind of products will be allowed under standardization rules.

For all the above, the implications must be stated in terms of finance, skilled human resources and time limits.

11.6.1.3 General services

Definition
As part of ICT strategy, the sub-subject ‘general services’ concerns the kinds of services which support the university community, the core business of the university and the activities related to that core business.

Description
General services cover a wide range of services offered to all those who are participating in education and research, the core business of the university, and all those who are involved in management and administrative tasks. To this range of services belong, for example, the traditional library systems, e-libraries, ICT service management, transport and medical facilities. The nature of these services is such that they all need ICT, people who can deliver the required services, and finance. They all have the potential for unlimited growth in various dimensions, with a great many implications. Therefore strategic directives have to be given in order to determine criteria for decisions on aspects such as centralisation versus decentralisation, or whether or not to change the services delivered.
Chapter 11 – The Conceptual Model

Prescription
Prescription includes the directives which position general services in relation to ICT in the total ICT strategy:

- The strategy must make clear what kind of services have to be developed, or are already operational and have to continue or have to be modified, through precisely formulated statements of services which have to be provided or modified.

- For these defined services, all steps must be stated in a logical sequence to ensure that activities are carried out correctly. This prescription corresponds to answering the questions formulated under the prescription of the main subject ICT strategy.

- With respect to charging for services delivered, attention must be paid to the level of input financing (from the university – central level) and the level of output financing (from the users, internal and external). The latter indicate the receipts and the balance or unbalance compared with the expenditures. Projects which require charging back will be confronted with internal and external competitive tariffs. This is one of the many considerations in a charging-back project and provides a strong reason for formulating charge back systems very clearly at the ICT strategic level.

11.6.1.4 Security

Definition
As part of ICT strategy, the sub-subject ‘security’ concerns the importance of securing personnel, hardware, software, communication facilities and data, as well as the issue of privacy. All these issues mentioned require management.

Description
Security needs ever more attention because of the increasing vulnerability of all university subjects and objects strongly dependent on ICT.

Worldwide access to the Internet, as an open communication network, creates numerous possibilities for damaging data. Backup and recovery facilities become more and more important for the continuity of education, research, management, administration and general services in the face of the manifest risks that are constantly around. The strengths of ICT and the threats to ICT have to be considered jointly. Recognition of this does not automatically lead to security in practice. Many examples are available showing how to improve security. What is required is a strong commitment from university top management to make security a serious subject.

Prescription
- Security must be based on risk management in which the questions that have to be answered are: ‘Which are the relevant risks to which attention must be given?’ ‘What preventive measures would prevent security incidents from occurring?’ and ‘What further reductive measures can be taken in advance to minimise any possible damage that occurs?’

- Detection is also required in order to discover the occurrence of a security incident as soon as possible.

- Repressive measures are necessary to counteract any continuation or repetition of the security incident.

- The damage incurred must be repaired using corrective measures.

- These measures are not one-off actions, but are the responsibility of a permanent security team which must be established, with clear terms of reference and adequate resources for undertaking this work.

- All these security measures must be complemented by adequate insurance cover for all ICT belonging to the university, and a clear commitment of the top management to meet the financial implications.
11.6.1.5 Investments and Costs

Definition
As part of ICT strategy, the sub-subject ‘investments and costs’ concerns the limits of ICT investments and costs, and also to what ICT subjects and objects they are related.

Description
Although prices of ICT are reducing, in reality total investments are increasing. A single PC or laptop may show an enormous price reduction over the years, but a different financial picture emerges when one takes into account needs for basic and application software, the linkage to local area networks and interconnections to wide area networks and Internet, together with maintenance.

Attention must be paid to the difference between investments and costs. We define investments as non-recurring expenses for the purchase of ICT, the useful life of which will be more than a year. The amount spent on the purchase will then be written off over a period of several years. Costs are defined as unavoidable expenses which either occur periodically or are meant for the purchase of ICT with a useful life of less than one year.

It must be emphasized that there are not only investments and costs related to development and acquisition of new ICT and existing operational ICT, but also investments and costs related to education and end-user computing programmes to enable users to use the ICT in an effective and efficient way.

Prescription
- An inventory of all planned and available ICT must be made, with ICT divided into categories mentioned in ‘Information Systems, Management, Control and Maintenance’.
- For each category, the investments and the costs must be calculated, as the consequences of new investments and the costs inherent in implemented and operational ICT.
  An approach to calculating the workplace costs is as follows:
  ▪ make inventories of each workplace without ICT;
  ▪ make inventories of the ICT of the workplace and their management;
  ▪ make inventories of the local network facilities and their management;
  ▪ make inventories of the external network facilities and their management;
  ▪ make inventories of the extra costs of facilities and management required for teleworking.
- The education needed for utilization and servicing must be planned and costed, bearing in mind that ICT is becoming more and more sophisticated and that acquiring the right knowledge is usually an expensive activity.

11.6.2 ICT Development/Acquisition

In relation to ICT development/acquisition we focus on the following five sub-subjects.

11.6.2.1 Development versus Acquisition

Definition
As part of ICT development/acquisition, the sub-subject ‘development versus acquisition’ concerns the comparative benefits and the disadvantages associated with ICT development and ICT acquisition.

Description
The sub-subject ‘development versus acquisition’ focuses on the object information system and software package. The in-house development of information systems such as student information systems, financial information systems and personnel information systems by one of the university’s own departments is well known. However, it must be stressed that
such developments are no sinecure. The same is true for software packages that support specific areas of administration or management. All these developments require huge efforts by staff members, as well as knowledge, finance and technical resources. At present many products are on the market and the trend is more and more to opt for acquisition and less and less for in-house development. However, we emphasize the difference between the effort, skills and resources need for the development of sizeable systems and packages, and the relatively modest requirements for the development of small and more individually oriented systems or packages based on Internet technology.

**Prescription**

Decisions on whether to choose an information system or software package from the market or to develop one in-house must take account of the particular circumstances. Nevertheless, the following guidelines are useful:

- Important reasons for deciding to choose an information system or software package from the market instead of one tailor-made by in-house development are:
  - relatively fast implementation;
  - avoidance of long development periods;
  - availability of a number of identical products;
  - availability of external support;
  - delivery of new releases and versions;
  - utilization of ‘best-practice’ experience from elsewhere.

- Reasons for in-house development instead of acquisition are:
  - the ability to concentrate on functionalities which are needed and exclude functionalities which are not needed or are just luxuries;
  - capacity building for in-house development, gaining knowledge and experience;
  - opportunity to align the needs and the ICT according to a one-to-one relationship.

- In order to take the decision whether to develop or to acquire, one should formulate the required functionalities in relation to the need to support or to replace existing activities (manual/automated) and preconditions such as finance, time and human resources.

This prescription relates to the whole development process and the acquisition process, including all elements which belong to the next sub-subjects.

**11.6.2.2 Requirements and Preconditions**

**Definition**

As part of ICT development/acquisition, the sub-subject ‘requirements and preconditions’ refers to the requirements concerning new or existing ICT and the preconditions concerning time, finance, knowledge and people that must be taken into account to avoid a waste of resources on realizing unlimited and irrelevant wants.

**Description**

A focus on user requirements results invariably in a number of highly qualified wishes. Examples of these wishes are:

- a broad scope of tailor-made functionalities;
- an ICT availability of 100 %;
- extremely high security;
- very fast solving of problems;
- availability of recovery facilities after calamities;
- unlimited access to Internet;
- unlimited and fast network facilities;
- an ICT reliability of 100 %;
- no charging for services.
These are the answers generally given to the question: 'What are your requirements concerning ICT utilization and ICT service management?'. In many cases these desires are stated without any knowledge of their consequences. Examples of these consequences are:

- having to provide for irrelevant functionalities;
- high investments and costs of providing for such functionalities;
- lack of finance, knowledge and technical facilities for provision of these functionalities;
- being unable to fulfil relevant requirements.

It is management's responsibility to define the preconditions or the framework within which the requirements have to be placed. This demands defining carefully considered limitations in order to preclude overly exacting user requirements for ICT utilization.

**Prescription**

- Formulating acceptable requirements and preconditions demands a serious approach with respect to real needs and practicability.
- The requirements of users must be related to the effectiveness and the efficiency of their activities. They must state what degree of reliability, availability, performance, security and other factors are needed to fulfil tasks in accordance with the objectives set by management, faculties and departments. If the outcome is not in accordance with the preconditions, it is a problem that has to be solved by management.

### 11.6.2.3 Development Process

**Definition**

As part of ICT development/acquisition, the sub-subject 'development process' concerns the aspects relating to the development of information systems and software packages.

**Description**

The development of information systems and software packages started with the implementation of the first computers. Over the years, many methods have been developed to support the process of developing information systems and software packages. These activities are concentrated in special development units of the university computer centres. The development process used to be characterized by a long development period. The process started with basic specifications but was often interrupted to introduce modifications and additions. In many cases, utilization of results occurred at the same time as ongoing additions, and without service level agreements. Typically, the planned development time was more than double in practice, or the activities were stopped before the expected results had been achieved. To help overcome such problems, many methods and techniques have been developed to support the development processes.

**Prescription**

The development process is qualified by the maturity level of the development organization. We distinguish the following levels of maturity in the development process:

- initial: the development is performed ad hoc;
- repeatable: project management controls the process with respect to costs and schedule. A consistent systems development methodology has been introduced;
- defined: the development process has been formally defined with all the specific tasks and deliverables;
- managed: a comprehensive programme of measurements is introduced, beyond that of measuring costs and schedules;
- optimising: the development process is optimised proactively, by using the experience from other projects. A continual quality improvement process is in place.

In the development process, the following sequence must be followed:
Chapter 11 – The Conceptual Model

- undertake a feasibility study (deliverables: recommendation to proceed and system proposal or recommendation to abandon);
- undertake a requirements analysis (deliverables: requirements specifications);
- prepare a logical design (deliverables: detailed design of system modules and databases; specification of system hardware and software);
- undertake coding and testing (deliverables: accepted system with complete documentation);
- installation (deliverables: installed operational system);
- undertake post implementation review (deliverables: recommendation for enhancement of the system and of the development method, recommendation for organizational adjustment).

This approach is in accordance with 'Foundations of Information Systems' by Zwass [1997].

Performing the development process needs support from project management, which is elaborated as one of the five sub-subjects of the main subject ICT implementation (see Section 11.6.3).

11.6.2.4 Acquisition Process

Definition
As part of ICT development/acquisition, the sub-subject ‘acquisition process’ concerns those aspects relating to acquisition of information systems and software packages.

Description
The market offers numerous information systems and software packages. Throughout the world suppliers are trying to sell a huge variety of systems and packages. At the beginning the systems and packages were focused on a special and well-defined application area, but over the years more and more systems and packages have come to cover broader areas. However, the relevance of these packages for covering the real needs to be questioned. Another question is: what are the immediate consequences for the existing organization when a package with a broad scope is implemented? The many and different aspects associated with the acquisition of an information system or a software package call for a professional approach.

Prescription
- The acquisition process must start with announcement of the Request for Proposals (RFP). This might or might not lead to a tendering process, but it is likely to result in receipt of responses from various suppliers.
- Tendering is appropriate when many organizations are able to respond positively to the same request, providing different prices, qualities and schemes of supplier-client after-sales services. This method follows the 'normal' path of ICT procurement used worldwide. The selection process is described in the next sub-subject.
- Acquisition must be followed by customisation (an essential part of installation), to adjust the system or package such that it conforms to the needs of the user organization and the service management organization.
- Customisation must be done by applying project management techniques, particularly those mentioned under ICT implementation.

11.6.2.5 Selection Process

Definition
As part of ICT development/acquisition, the sub-subject 'selection process' concerns the methods and techniques that support selection of the most convenient suppliers for the required product.
Chapter 11 – The Conceptual Model

Description
When a number of ICT suppliers with ICT products have responded to a Request for Proposals, it is usually quite difficult to select the most convenient ones. Care is needed to avoid incorrect decisions which may have negative and unacceptable consequences. We therefore advise the use of proven methods and techniques (such as those in the Prescription below) to support the selection process.

Prescription
- Multi-criteria analysis, described in detail in ‘Information Systems Management, Control and Maintenance’ and Supplement [Looijen1998], must be applied to define the decision criteria.
- Criteria should then be grouped in categories.
- For each criterion, the responses of the invited ICT suppliers are given a rating (e.g. from zero, very low, to five, very high).
- Criteria are prioritised by allocating weight factors to express the importance of each.
- For each criterion the final score is calculated by multiplying the respective rating by the weight factor.

The following example illustrates the selection of one software package out of three proposals.

<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria</th>
<th>Priority (weight)</th>
<th>A rating</th>
<th>A score</th>
<th>B rating</th>
<th>B score</th>
<th>C rating</th>
<th>C score</th>
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<td>50</td>
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<td>3</td>
<td>30</td>
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<td>1</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>5</td>
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<td>5</td>
<td>45</td>
<td>4</td>
<td>38</td>
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<tr>
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</tr>
</tbody>
</table>

This example shows that A has the highest score and should be selected for implementation.

11.6.3 ICT Implementation

In relation to ICT implementation we focus on the following five sub-subjects.
11.6.3.1 Project Management

Definition
As part of ICT implementation, the sub-subject ‘project management’ concerns the need to manage ICT projects using project management methods and techniques. Project management is the application of knowledge, skills and resources to project activities within an organizational and procedural framework, in order to meet the needs and expectations of the stakeholders within a period of time. For recommended reading, see Section 11.5.3 - Literature.

Description
Management of activities and projects is a general issue. Nevertheless it is well known that project management frequently fails or is not treated seriously. There are numerous examples of over-running original planned periods, human resources, technical resources and financial means. There are also many examples of projects which never started, or which started but were never completed. These illustrate the need for and the fulfilment of clearly defined project management targets in order to realize and to maintain ICT projects such as ICT strategy development, ICT development, ICT acquisition and ICT implementation. It must be understood that project management needs people who understand and have experience in how to manage projects.

Prescription
Before starting project management, one should answer the following question:
- **WHAT** is the project?
  The project is a temporary organization, which is necessary in order to realize a product within a defined period, using resources which have been determined in advance.

Another question that has to be answered is:
- **WHY** project management?
  Project management aims to ensure that the product is realized, with satisfactory quality, within the stipulated period, using the resources allocated in the most effective way.

We can distinguish a number of processes that fall under the umbrella ‘project management’:
- Initial planning: this includes preparatory activities such as defining a project proposal and appointment of a project manager and steering committee.
- Starting up: this includes a description of the activities and responsibilities of the project manager and a description of the products which have to be delivered.
- Directing: this refers to the role of the steering committee.
- Controlling: this refers to the daily work of the project manager.
- Managing product delivery: this includes the performing of activities of project members.
- Closing: this includes a structured final phase of handing over and acceptance of the realized product.

11.6.3.2 End-User Training

Definition
As part of ICT implementation, the sub-subject ‘end-user training’ concerns the need for training the users of ICT on a continuous basis.

Description
An effective and efficient usage of ICT needs users who understand the functionality of the ICT and how to use it. Implementation of ICT is not merely installing it and observing whether it works. It is quite inadequate to instruct only a few people in the utilization of ICT while leaving many others to struggle on their own to become familiar with the ICT which they must use in their daily work.
Prescription
Implementation of ICT requires education programmes for those who are confronted with having to use that ICT. These education programmes have to be delivered by the supplier of the ICT or by institutes specialized in the utilization of that ICT. This approach must be guided by the answers to the following questions:

- WHAT are the functionalities of the ICT?
- WHAT is necessary in order to use the functionalities in an effective and efficient way?
- WHICH suppliers/institutes are able to deliver the required education?

11.6.3.3 Management, Control and Maintenance Training

Definition
As part of ICT implementation, the sub-subject ‘management, control and maintenance training’ concerns the need for continuous training of the people who are involved in ICT service management.

Description
Those who will be responsible for the management, control and maintenance of the implemented ICT must be provided with the knowledge of how to do this. All too often, those responsible manage, control and maintain ICT on the basis of their own practical experience, driven by events rather than by forward planning. A structured approach which includes well-defined processes is required, together with the knowledge needed for carrying out these processes. ICT is too expensive, too complicated and too important for the organisation to be managed, controlled and maintained on a fragmented and personal basis. Good training programmes are therefore indispensable.

Prescription
The content of management, control and maintenance training has to be derived from the answers to the following questions:

- WHAT ICT has to be managed, controlled and maintained?
- WHICH organisation is responsible for that management, control and maintenance (see also 11.6.5.1)?
- WHAT processes have to be implemented or are already available to manage, control and maintain that ICT (see also 11.6.5.2 and 11.6.5.3)?
- WHICH knowledge and skills are necessary to manage, control and maintain the implemented ICT?

The answers to these questions will define the required education/training programmes.

11.6.3.4 Service Level Agreements

Definition
As part of ICT implementation, the sub-subject ‘service level agreements’ concerns the need to define and specify the services and the level of the services required by the ICT users and offered by ICT service management.

Description
ICT implementation will be followed by ICT utilization and ICT service management. Between the latter two there is a strong relationship of interdependence. Lack of rules or procedures to guide that interdependence will, in general, lead to ad hoc and event-driven service management to support ICT users. Because of the number and diversity of services the user needs, there must be a clear overview concerning the needs of the user and the services to be delivered. Such an overview is called a Service Level Agreement, and should be developed before ICT utilization and ICT service management start.
Chapter 11 – The Conceptual Model

**Prescription**
A Service Level Agreement (SLA) is an agreement in which the rights and duties between two parties are laid down. The two parties may be an ICT user organisation and an ICT service management unit. A typical SLA will include definition of the following:
- representatives of both parties,
- the subject of the agreement,
- the commencing date of the service,
- the availability of the ICT,
- the security level required,
- disaster regulations,
- change allowance,
- payment, and the
- duration of the agreement.

For more detailed information on SLAs we refer the reader to ‘Information Systems Management, Control and Maintenance’ [Looijen1998].

It is important to ensure that the required and offered services are feasible and the level of services is widely known by users. As soon as ICT utilization and ICT service management are active, the SLA will be part of Service Level Management, which supervises the agreed rights and duties.

### 11.6.3.5 Testing

**Definition**
As part of ICT implementation, the sub-subject ‘testing’ concerns the need to verify and validate developed and acquired ICT and to explore the ability of ICT users and ICT service management to operate on the right level.

**Description**
All too often, ICT utilization and ICT service management follow immediately after the ICT development or acquisition phases. Errors in hardware and/or in software will only be detected in the states of utilization and exploitation. More often than not, the user organisation and the service management organisation are not adequately equipped with knowledge and skills to be able to accept or reject the new ICT, resulting in a mixture of unstructured activities around insufficiently tested issues concerning, for example, the ICT and user and service organisations.

**Prescription**
Testing the ICT before ICT utilization and ICT service management start must provide answers to the following questions:
- Does the ICT correspond to the rules of verification (logical specifications)?
- Does the ICT correspond to the rules of validation (functional specifications)?
- Is the user organisation able to use the ICT?
- Is the ICT service management organisation able to manage, to control and to maintain the ICT?

Only when all answers are ‘YES’, can the ICT progress from the implementation stage to utilization and servicing.

**11.6.4 ICT Utilization**

In relation to ICT utilization we focus on the following five sub-subjects:
11.6.4.1 Effectiveness and Efficiency

Definition
As part of ICT utilization, the sub-subject 'effectiveness and efficiency' concerns the need for effective and efficient ICT utilization.

Description
Utilizing ICT in the present day differs very much from utilizing ICT a few years ago. Then terminals were used, which offered a functionality of being part of centralized information systems. The use of terminals was dictated by these systems and was confined to so-called computer professionals. Today, Personal Computers and laptops are well known and widely distributed. At home and in Internet cafés young and older people become very familiar with ICT. However, this does not mean that all these people automatically obtain the knowledge and experience needed for applying ICT within an organisation in such a way that it influences the business in effectively and efficiently.

Prescription
Applying ICT at universities in education, research, management, administration and general services must be coupled with objectives. It is part of the responsibilities of the universities to define these objectives. As long as the only objective is to obtain more and more PCs, to the exclusion of objectives concerning expected effectiveness and efficiency, the university can be characterized as being 'very simple'. This situation has to be replaced by the following approach:
- Define the effectiveness required in relation to applying ICT in education, research, management, administration and general services.
- Define the efficiency required in relation to applying ICT in education, research, management, administration and general services.
- Create facilities to measure and/or to judge effectiveness and efficiency in practice.
- Take measures to influence effectiveness and efficiency in practice, and compare the levels achieved with the defined objectives.

11.6.4.2 User Skills

Definition
As part of ICT utilization, the sub-subject 'user skills' concerns the need to have the correct user skills for using newly implemented and existing ICT.

Description
After ICT is installed, there is no guarantee that users will be able to use that ICT in accordance with the available functionality and their daily activities. Users must understand the functionality of the ICT and how to use it, including understanding its potential and its constraints, what is permitted and what is not permitted or not useful. To understand these, they must have the right skills. Otherwise they use ICT as a toy, unable to make the most of its opportunities.

Prescription
In order to give attention to the skills that are necessary for using ICT in an optimal way, we formulate the following actions:
- Identify and distinguish between the different areas for ICT application: education, research, management, administration and general services.
- Derive from these areas the skills which are needed in order to apply ICT in accordance with defined objectives.
- Determine the education programmes required for teaching the right skills and for maintaining the level of these skills.
11.6.4.3 Management, Control and Maintenance Relationships

Definition
As part of ICT utilization, the sub-subject ‘management, control and maintenance relationships’ concerns the relationship between ICT users and those who are responsible for ICT service management.

Description
Utilizing ICT requires support from those who are responsible for management, control and maintenance of operational ICT. There are many examples of practical situations where there is a strong personal element in such a support. Procedures which describe clearly the relationship between ICT users and ICT support organisations are missing. The relationships are based more on individuals than on organisational structures, leading to much dissatisfaction on both sides. Instead, a more structured approach to promote good relationship between ICT users and ICT management, control and maintenance is required.

Prescription
Relationships between ICT users and those who are responsible for ICT service management (in other words ICT management, control and maintenance) must be based on the following:
- Service Level Agreements (see 11.6.3.4) between the two parties.
- A Functional Management (see 11.6.5.1), which supports the ICT users in a direct form.
- An incident management which includes a Help Desk and is part of the ICT management, control and maintenance or ICT service management (see 11.6.5.2)

11.6.4.4 Security Awareness

Definition
As part of ICT utilization, the sub-subject ‘security’ concerns the need to secure ICT and data to avoid damage and calamities.

Description
Users of ICT have a high degree of responsibility for the ICT, including hardware, software, data and procedures they are using. However, users do not automatically take security to be a serious issue. Many assessment reports with respect to security awareness and application of security measures emphasize the low level of security awareness. Security awareness is prompted when risks manifest themselves and cause damage to software and/or to databases: then the frightened user takes measures to avoid repetition of such damage. Mostly these measures are individual actions, which cost time and money and do not always result in complete repair.

In relation to this practical problem we ask the question: what has to be done to create and to keep security awareness at such a level that users understand risks and are able to take measures to avoid calamities and to reduce and/or to repair damage?

Prescription
Creating security awareness must be an ICT strategic issue and must be launched at the highest management level of the university. Activities and measures must be derived from the strategic statement to give that statement practical content. This leads to the following approach:
- Illustrate by examples the consequences of absence of security awareness.
- Prescribe the risks related to ICT.
- Illustrate the consequences of manifestations of these risks.
- Take measures to prevent manifestations of these risks.
- Take measures that can be activated after manifestations of risks, to reduce and to repair damage.
Chapter 11 – The Conceptual Model

11.6.4.5 Cost Awareness

Definition
As part of ICT utilization, the sub-subject ‘cost awareness’ concerns the need for understanding the costs related to ICT and charging back services that are delivered.

Description
Utilization of ICT is coupled to ICT maintenance and ICT service management. At present many situations illustrate that there is still a very low cost awareness on the part of users, because they do not have to pay for ICT use. The formula is: the user asks, the user gets; somebody else has to pay for maintenance and delivering services. The user is not concerned about this real and important issue. Such situations are well known at universities. However, as soon as an external organisation is doing ICT maintenance or is delivering services, it must be paid (and users accept this without any surprise). It is therefore advised that ICT users of universities become aware of direct and indirect ICT costs. They must understand that before money can be spent, money must be obtained, and that obtaining money is usually very difficult.

Prescription
Cost awareness as defined above requires the development of financial management for ICT services. This development includes:

- Developing an ICT accounting system that is based on what must be done, why it must be done, and who is affected by doing it. This system is a set of processes that enable the user organisation to account fully for the way its money is spent on ICT.
- Developing a charging system. This system is a set of processes required for billing ICT users for the services supplied to them (see 11.6.5.5).

11.6.5 ICT Service Management

In relation to ICT service management we focus on the following five sub-subjects:

11.6.5.1 Three Kinds of Management, Control and Maintenance

Definition
As part of ICT service management, the sub-subject ‘three kinds of management, control and maintenance’ concerns the three kinds of management, control and maintenance (service management) and the relationships between these three.

Description
In practice, management, control and maintenance is a mixture of activities and is strongly concentrated in the computer centre of the university. In that centre, a diversity of disciplines comes together to manage, to control and to maintain the ICT which is dispersed over many locations in the university. It is the computer centre which plays an essential role in supporting ICT users. This central position within the university is similar to the prevailing situations in Europe and USA a number of years ago. However, since the arrival of the PC and local area networks within faculties and administration departments, small groups or single persons start to undertake local management, control and maintenance activities. There are many reasons for doing this: for example, the diversity of activities, processes, needs for money and skills. Therefore we strongly advise a structured approach to the fulfilment of ICT management, control and maintenance (MCM).

Prescription
From the managerial and organisational point of view we distinguish the following three kinds of management, control and maintenance:

- Functional management: this includes providing direct support to ICT users with regard to the functionality of the ICT.
Chapter 11 – The Conceptual Model

- Application management: this includes the maintenance of the application software and data files.
- Technical management: this includes the management, control and maintenance of the technology (hardware, system software and communication facilities) as well as support to ICT users with regard to that technology.

Each kind of MCM has its own activities, processes, skills and responsibilities, but each kind is inter-connected to the others.

The three kinds of MCM play an essential role in the realization of MCM in the different organisations which are responsible for MCM or a part of MCM. For the content of technical management we refer the reader to paragraphs 11.6.5.2 and 11.6.5.3, as well as to Chapter 5 of 'IS Management, Control and Maintenance' [Looijen1998]. For the content of application management and functional management we refer to Chapter 5 of ‘IS Management, Control and Maintenance’.

11.6.5.2 Service Support Subjects

Definition
As part of ICT service management, the sub-subject ‘service support subjects’ concerns the processes of incident management, problem management, configuration management, change management and release management.

Description
ICT can be considered as a moving object. Problem solving and execution of changes are part of the daily activities of ICT service management. ICT is frequently replaced by new products, either because it needs repair or because more advanced technology has been introduced.

It is important to acknowledge that all service support activities have to be done on behalf of the ICT users. Their daily work, supported by ICT, frequently raises questions and complaints which must be answered by ICT service management. Therefore ICT service management needs a structured approach which covers the so-called service support subjects.

Prescription
The service support subjects, transformed into mutually related processes, include the following:
- Service Desk: the initial point of contact with ICT service management for the ICT users.
- Incident Management: resolving incidents and restoring provision of service as soon as possible.
- Problem Management: identifying the underlying cause if a problem is suspected.
- Change Management: addressing a controlled implementation of changes to software, hardware and communication facilities (ICT).
- Configuration Management: centralizing all ICT items and providing up-to-date information about the available ICT.
- Release Management: ensuring correct transport of configuration items to the right ICT and locations.

Mutual relations require close interaction between all these processes.

11.6.5.3 Service Delivery Subjects

Definition
As part of ICT service management, the sub-subject ‘service delivery subjects’ concerns the processes of service level management, financial management, capacity management, continuity management and availability management.

240
Chapter 11 – The Conceptual Model

Description
The description given for service support subjects (11.6.5.2) also applies to service delivery subjects, and the prescription given for service delivery subjects should be seen as complementary to the prescriptions given for service support subjects. Thus these two sub-subjects must be realized in conjunction, forming an integral package of subjects for a professional ICT service management.

Prescription
The service delivery subjects, transformed into mutually related processes, include the following:

- Service Level Management: responsible for ensuring Service Level Agreements and other contracts.
- Financial Management: including budgeting, ICT accounting and charging.
- Capacity Management: responsible for ensuring adequate ICT capacity to meet the requirements of the ICT users.
- Continuity Management: responsible for an organisation’s ability to continue after interruptions caused by calamities.
- Availability Management: responsible for ensuring the availability of ICT.

Mutual relations require close interaction between all these processes.

11.6.5.4 User Relationships

Definition
As part of ICT service management, the sub-subject ‘user relationships’ concerns the relations between ICT service management and the ICT users with respect to the requesting and delivery of services.

Description
Good and user-friendly relations between ICT utilization and ICT service management are practically impossible without agreements and clear procedures. The diversity of available ICT and of ICT users and their required services demands well-defined user relationships to guarantee an acceptable level of cooperation between two different ICT areas: using and servicing.

Prescription
With reference to Management, Control and Maintenance Relationships or ICT service management relationships we prescribe the following for the promotion of good ICT user relationships:

- Supervise Service Level Agreements containing the rights and duties of those who are servicing ICT and those who are requesting services.
- Perform the processes mentioned under 11.6.5.2 (service support) and 11.6.5.3 (service delivery).

11.6.5.5 Charging

Definition
As part of ICT service management, the sub-subject ‘charging’ concerns how services are charged to internal (within the university) and external organizations.

Description
ICT users within the university (in the areas of education, research, management, administration and general services) usually do not pay for ICT servicing. Lack of financial management makes it easy for those who are involved in ICT utilization and ICT service management to function without any regard for costs.
In contrast to this, we emphasize the need to charge internal users for services in the same way that external organisations are charged. Charging creates awareness that without financial means, there will be no ICT, no utilization and no service. Internal charging may thus be seen as an effective tool to encourage ICT users to use ICT more carefully. However, it should be noted that since budget holders in the university often do not charge for services such as accommodation, telephone, catering and administration, charging for ICT will probably meet opposition.

**Prescription**
Taking the decision to introduce charging implies recovering all or part of the costs incurred. In this case, ICT service management will operate as a business unit, which must know the actual operating costs of ICT service management. Items which are essential to understand for those who are developing a charging system are:

- **Charging policy:** a charging policy has to be chosen out of a number of policies such as:
  - ICT users are only informed about the charges to make them aware of the costs of ICT services;
  - rates are determined and charged on the basis of what really happens: less service, more service, additional service;
  - costs are invoiced but there is no need for payment: the objective is to gain experience of charging for services.

- **Price setting:** includes a number of activities such as:
  - defining the objective of pricing;
  - determining direct and indirect costs;
  - determining market prices;
  - analysing requests for services;
  - analysing the number of ICT users.

- **Billing:** bills must be simple; clear and chargeable services must be understood by the ICT users.

It must be emphasized that development of a charging system has to be considered as a project. Project members should represent the disciplines of financial management, ICT service management and ICT user organisation.
12. SYSTEM REALIZATION

The objective is to present the automated tool of the Big ICT Five Conceptual Model described in Chapter 11. For the system realization, the object oriented analysis (OOA) method is followed. OOA is a complete set of models and diagrams and includes dialogue design, real time tasks, communications and hardware considerations, and designing the database. All these constitute a good base for the automation of the Big ICT Five Conceptual Model.

12.1 Introduction

According to Coad and Yourdon [1990], in OOA there are activities that need to be performed before the automated tool can be obtained. We therefore start by describing these activities in the order in which they take place, from higher to progressively lower levels of abstraction. The activities are realized in six steps, as follows:

Step 1 Recapitulation of the current situation of the technological resources, skills and the Big ICT Five Model in the universities

Step 2 Presentation of the technological solution for the automation of the Big ICT Five Model

Step 3 Transformation of the Big ICT Five Model into a class diagram

Step 4 Presentation of an action diagram showing the dynamic interfaces and sequences

Step 5 Creation and presentation of the interfaces

Step 6 Populating the classes/objects with real data and launching the system online on the Internet.

For the successful realization of the Big ICT Five Conceptual Model, a strong architectural vision and a well-managed iterative and incremental development life cycle are required. 'Architectural vision' means the system to be designed has conceptual integrity, encompassing its class and object structure, which are organized in distinct layers and partitions. 'Iterative and incremental development life cycle' means that the process of system software development involves the successive refinement of an object-oriented architecture, from which we apply the experience and results of each version to the next iteration of analysis and design. The process is incremental in the sense that each completed analysis/design/evolution cycle leads us to gradually refine our strategic and tactical decisions, ultimately converging upon a solution that meets the end users' real (and usually un-stated) requirements, and yet is simple, reliable, and adaptable.

12.2 Step 1. Recapitulation of the current situation of the technological resources, skills and the Big ICT Five Model in the universities

Chapters 5 to 10 describe the level of penetration and usage of ICT in each of the six universities. In all areas of these universities, ICT is a well-known object and we find a substantial level of usage of ICT for education, research, services, administration and management processes. Advanced ICT is available at many locations. Over the years, wide university networks have been implemented and are in use by many staff members and students. Education in ICT takes place. Staff members, of all levels, are able to participate in conferences, workshops and management meetings on ICT, both within and outside their university. Access to Internet offers possibilities to communicate with people in all parts of the world. Thus, a variety of ICT objects and subjects are already given attention or play a role in the planning, application, utilization and the management of ICT.
The utilization of ICT is mainly PC-oriented, although multi-user systems are in place for administration of academic processes, educational programmes and support services. Academic units generally have computer laboratories to serve students and academic staff. These are the areas of most concentrated use. ICT utilization however is not optimal. Insufficient ICT and lack of knowledge prevent the academic, administrative staff and students from getting the best out of the available ICT. Since most ICT is acquired through donations within cooperation projects in which financial resources are immediately available for capital investment, users become less informed/sensitive to the costs of the various components involved in ICT. Dealing properly with strategic issues in order to achieve effective management of ICT infrastructure and of the flow of users could expand the ICT user population within universities. These and other strategic issues such as understanding the ICT in/for use, know-how regarding ICT security in an university environment and more realistic assessments of training needs and costs, need to be properly addressed.

Chapter 11 describes the Big ICT Five Conceptual Model, which serves as a tool for supporting the understanding and the application of the subjects ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT service management in higher education institutions in Africa. The tool is meant to help those who have responsibilities concerning one or more of the ICT management subjects.

The model delivers information in such away that it helps them to understand the significance and the content of a number of relevant subjects including indications how to accomplish those subjects. In other words the model includes descriptions on the level of WHAT to understand and includes directives in the sense of WHAT and HOW to implement.

The model, as it is in Chapter 11, can be manually applied. However, its automation provides an enhanced tool for ICT management at each of the designated levels of the university (users, managers, administrators, technical). By being made available on the Internet, the six universities are able to make use of it everywhere, wherever the Internet is available.

12.3 Step 2: Presentation of the technological solution for the automation of the Big ICT Five Model

The automation of the Big ICT Five model is based in the client/server concept (Figure 12.3.1). The Client is a set of computers with access to Internet belonging to the universities, and the Server is a computer based at CIUEM containing the Big ICT Five Model system to be accessed by clients via the Internet. The Server is at the following address http://www.bigictfive.uem.mz with the following IP number 196.3.96.21.

![Figure 12.3.1 – Client Server Concept](image)

The technological solution implemented is as follows:
Chapter 12 System Realization

For the universities to obtain access from any location, the computer (with Unix Free BSD operating system) at CIUEM containing the Big ICT Five model system is a WEB Server from which the structure of the model is presented in HTML.

Given that the objects are dynamic and to allow operations such as update of data, alteration of data, introduction of new data, maintenance of data and integrity/security of data, objects are handled by a database management platform mySQL DBMS which is in the Server. Such operations can be carried out through Content Management System (CMS) via WEB from CIUEM or from any other place provided that the person who executes the operation is authorized to do so.

The basic technical infrastructure is located at UEM, where:

- A centralized server is available
- Acceptance or not of the proposed alterations on the model is made. In this way, UEM acts as coordinator of the modifications, such as adding and/or changes to the definitions, descriptions, prescriptions, references and adding new sub-subjects. The server data base will be updated only after acceptance of changes, and the information will be available to all clients on the Internet.

For the creation of the data dictionary, data tables and data forms, the Structured Query Language (SQL) database programming language is used. In conjunction with SQL, the PHP programming language is also used in the Server to codify commands that permit data acquisition from the database and data visualization by the client through WEB Browser. It also allows the client to submit data forms for updating, alteration, deletion or entry of data.

The software Web Server 1.19 interfaces the interaction between the database programming language and the client.

The database files are saved in the Server with an extension *.php and are constructed by combining commands of PHP and HTML.

The Internet (Figure 12.3.2) permits access and usage of the Big ICT Five System Model from any place where access to Internet is possible and, given the proven easiness of navigation through Websites, users of the model can easily consult (use) the model at their convenience.

![Diagram of System Realization](image)

Figure 12.3.2 – Technical Realization of The Big ICT Five Model
12.4 Step 3. Transformation of the Big ICT Five Model into a class diagram

In this step, identification of classes and objects, semantics of classes and objects, identification of relationships among classes and objects, and implementation of classes and objects are done. This is achieved by building the class diagram (Figure 12.4.1), which shows class identification, all attributes and operations taking place in each class and associations among classes. In all classes, the field ‘operations’ is limited to create/read/delete/update, i.e. all classes are primitive.
Figure 12.4.1 Mapping the Big ICT Five Model into Class Diagram
**Description:**

In general, strategic plans are very detailed documents that include a mixture of non-ICT and ICT subjects, but do not detail concrete plans nor provide the basis for projects for the realization of ICT.

Five objects/classes are identified: education and research, management and administration, services, security, and investment and costs.
12.4.2 ICT Development/Acquisition

Description:

Decisions on development of software and acquisition of software and hardware products are mostly made locally. Formal directives in relation to the advantages and disadvantages of development or acquisition are missing. Decisions made within the universities and by outside donors both play an explicit role in the selection process with respect to ICT development or ICT acquisition.

Five objects/classes are identified: development versus acquisition, requirements and preconditions, development process, acquisition process, and selection process.
12.4.3 ICT Implementation

Figure 12.4.4 - Class Diagram ICT Implementation - IPL

Description:

ICT implementation is focused on ICT utilization, rather than on a balance between ICT utilization and an ICT service management that is immediately able to support ICT utilization after ICT implementation is completed.

Five objects/classes are identified: project management, end user training, management control and maintenance training, service level agreements and testing.
12.4.4 ICT Utilization

Figure 12.4.5 - Class Diagram ICT Utilization - UTZ

Description:

An effective and efficient use of ICT needs a good understanding of that ICT. In this respect, education programmes are indispensable. These must contain correct education on different levels of ICT utilization and must be balanced in order to serve all staff members, rather than always the same few. There is often little understanding of the rights and duties of ICT utilization, or these are defined in a one-sided way in service level agreements (SLAs) prepared by technically-oriented people involved in ICT service management.

Five objects/classes are identified: effectiveness and efficiency, user skills, management control and maintenance relations, security awareness and cost awareness.
12.4.5 ICT Service Management

Description:

With reference to a transformed Capability Maturity Model of management, control and maintenance of information systems (Supplement to Looijen 1998), ICT service management operates at the lowest level. One main characteristic of current ICT service management is that it is event-driven. The role of ICT service management in education and research is either neglected, or only weakly integrated in the core business of the universities.

Five objects/classes are identified: three kinds of management control and maintenance, service support subjects, service delivery subjects, user relationships and charging.
Chapter 12 System Realization

12.5 Step 4: Presentation of an action diagram showing the dynamic interfaces and sequences

1. ICT Strategy
   - Definition
   - Description
   - Prescription
   - Reference

1.1 Education and Research
1.2 Management and Administration
1.3 General Services
1.4 Security
1.5 Investments and Costs

1.3 General Services
   - Definition
   - Description
   - Prescription

1.2 Management and Administration
   - Definition
   - Description
   - Prescription

1.1 Education and Research
   - Definition
   - Description
   - Prescription

Figure 12.5.1 Action Diagram ICT Strategy
Chapter 12 System Realization

Figure 12.5.2 Action Diagram Development/Acquisition
3. ICT Implementation

3.1 Project Management

3.2 End - User Training

3.3 Management, Control and Maintenance Training

3.4 Service Level Agreements

3.5 Testing

Figure 12.5.3 Action Diagram ICT Implementation
Chapter 12 System Realization

Figure 12.5.4 Action Diagram ICT Utilization
5. ICT Service Management

5.1 Three Kinds of Management, Control and Maintenance

5.2 Service Support Subjects

5.3 Service Delivery Subjects

5.4 User Relationships

5.5 Charging

Figure 12.5.5 Action Diagram ICT Service Management
12.6 Step 5: Creation and presentation of the interfaces

**BUILDING AWARENESS AND SUPPORTING AFRICAN UNIVERSITIES IN ICT MANAGEMENT**

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**TITLE**

THE BIG ICT FIVE MODEL

**MODEL OBJECTIVE**

This conceptual model serves as a supporting instrument for developing and implementing Information and communication technologies in higher education institutions in Africa. Its users will have a tool that, when properly applied, will reduce the problems these institutions are currently facing. These problems are related to the following subjects:

- ICT strategy;
- ICT development/acquisition;
- ICT implementation;
- ICT utilization;
- ICT service management.

In the conceptual model we distinguish the sub-subjects associated with each subject. Five sub-subjects are identified per subject, and the main content of each one is further detailed.

**HOW TO USE**

This screen is the first entrance into the automated part of the Model. In order, to get access to the model, you must have a valid Username and Password supplied by the author.

To proceed Click Here
Chapter 12 System Realization

BUILDING AWARENESS AND SUPPORTING AFRICAN UNIVERSITIES IN ICT MANAGEMENT

4. ICT UTILIZATION

DEFINITION:

DESCRIPTION:

1. ICT STRATEGY

PRESCRIPTION:

REFERENCES:

2. ICT DEV./ACQUISITION

3. ICT IMPLEMENTATION

4. ICT UTILIZATION

5. ICT SERVICE MANAGEMENT

4.1 EFFECTIVENESS AND EFFICIENCY

4.2 USER SKILLS

4.3 MANAGEMENT, CONTROL AND MAINTENANCE RELATIONSHIPS

4.4 SECURITY AWARENESS

4.5 COST AWARENESS

HOME
BUILDING AWARENESS AND SUPPORTING AFRICAN UNIVERSITIES IN ICT MANAGEMENT

5. ICT SERVICE MANAGEMENT

DEFINITION:

DESCRIPTION:

PRESCRIPTION:

REFERENCES:

1. ICT STRATEGY

2. ICT DFM ACQUISITION

3. ICT IMPLEMENTATION

4. ICT UTILIZATION

5. ICT SERVICE MANAGEMENT

5.1 THREE KINDS OF MANAGEMENT, CONTROL AND MAINTENANCE

5.2 SERVICES SUPPORT SUBJECTS

5.3 SERVICE DELIVERY SUBJECTS

5.4 USER RELATIONSHIPS

5.5 CHARGING
12.7 **Step 6: Populating the classes/objects with real data and launching the system online on the Internet**

The final step is to introduce the content of the subjects and sub-subjects of the Big ICT Five as presented in Chapter 11.
13. VALIDATION

The objective of this validation is to examine, together with the selected universities, the outputs of the research project, namely:
- the assessments of the universities,
- the conceptual model, and
- the automated tool.

13.1 Introduction

Following production of the outputs of the research project, it is necessary to confirm the adequacy of the assessments of the ICT situation in the six universities and to ratify the conceptual model and automated tool. This process is known as validation.

Validation involves, first, careful examination of the assessments in order to ensure that they reflect the real ICT situation in each university and, secondly, examination of the model in order to confirm that it meets the exact needs of users and is suitable for its intended purpose. The validation is conducted through a questionnaire sent to the participating universities, thereby giving the universities an opportunity to give feedback on whether the research outputs have been properly developed.

Validation will help to assure that the model can be applied/used without problems and improve the level of control and reliability of the model. It can also help increase user acceptance. As the automated tool aims to facilitate using the model, validation also looks at aspects of portability and ease of navigation.

Validation takes place prior to the implementation of the model and therefore requires careful planning and setting up of an appropriate validation methodology.

The validation methodology adopted involves the following steps:

Step 1 Preparation of questions(s) concerning the assessments made of the ICT situation in the six universities, with the aim of verifying whether they are correct.

Step 2 Preparation of question(s) concerning the conceptual model, with the aim of verifying its usefulness.

Step 3 Preparation of question(s) concerning the automated tool, with the aim of verifying its effectiveness.

Step 4 Preparation of a letter to be sent to the universities, setting out the three categories of questions developed in steps 1-3 and including, as attachments, the relevant assessment chapter, the conceptual model (Chapter 11) and the automated tool (Chapter 12).

Step 5 Compilation and synthesis of the responses from the six universities.

Step 6 Conclusions regarding the validity of the research outputs.
Chapter 13 Validation

13.2 Step 1: Preparation of questions(s) concerning the assessments made of the ICT situation in the six universities, with the aim of verifying whether they are correct.

It is considered that the information required from the universities can be elicited through a single question:

a) Are there any significant omissions or errors in this assessment?

13.3 Step 2: Preparation of question(s) concerning the conceptual model, with the aim of verifying its usefulness.

The following questions are proposed:

a) Is Chapter 11 easy to read for the potential users of the conceptual model (in terms of layout and language used)?

b) Is Chapter 11 understandable to the potential users of the conceptual model (in terms of clarity of expression)?

c) Does the model create awareness concerning:
   - ICT strategy?
   - ICT development/acquisition?
   - ICT implementation?
   - ICT utilization?
   - ICT service management?

d) Does the model provide support to the application of:
   - ICT strategy?
   - ICT development/acquisition?
   - ICT implementation?
   - ICT utilization?
   - ICT service management?

13.4 Step 3: Preparation of question(s) concerning the automated tool, with the aim of verifying its effectiveness.

The following questions are proposed:

a) Is the automated tool easy to use (navigate)?

b) Does it give extra value to the conceptual model compared with the written form of the model?

13.5 Step 4: Preparation of a letter to be sent to the universities, setting out the three categories of questions developed in steps 1-3.

The letter prepared and sent to the universities of Botswana, Dar-Es-Salaam, Eduardo Mondlane, Namibia, Swaziland and Zambia is presented in Annex 6. The relevant assessment chapter, the conceptual model (Chapter 11) and automated tool (Chapter 12) were annexed to the letter and the WEBSITE address was given for navigation of the automated tool.
Chapter 13 Validation

13.6 Step 5: Compilation and synthesis of the responses from the six universities

The full responses of the universities are set out in Annex 7. In general, mandate to provide the answers was given to the Directors of the Computer Centres.

With regard to the assessments:

- UDSM, UEM, UNAM and UNISWA indicated their specific agreement to the analysis contained in their respective chapters. UEM requested rectification of some specific details, particularly some of the diagrams, whilst UDSM, UNAM and UNISWA also suggested minor corrections, which have been made.

- UNZA undertook a thorough revision of typographical errors. All the suggested alterations were made and are now reflected in the final version of each assessment.

- UoB requested corrections to some tables and conclusions, and most of these have been made. The Deputy Vice-Chancellor commented that the information gathered for the assessment is now outdated, because of the change in the top management of the university. This is certainly the case, and we have witnessed dynamic changes in ICT infrastructures, organization, procedures and management of UoB. However, the assessment must reflect the situation during the period in which the research was carried out. In reply to UoB’s other comment that the assessment “takes an auditor’s approach”, we emphasise that the assessment was not based on an unstructured observational approach but followed specific models, as described in Chapter 4. These models were also presented at the workshop held in Maputo (Chapter 3).

With regard to the conceptual model (Chapter 11), the universities made various comments and suggestions, all of which we carefully analysed and considered. The main issues raised and our responses are as follows:

- UoB considered that the term ‘sub-subjects’ was unusual, confusing and may not be easily understood.

  After reflection, we are convinced that this terminology is appropriate and that the explanation in Section 11.3 is clear.

- UoB also commented that the appealingly consistent structure for the model is not followed through in the approach to the prescriptions for the subjects and sub-subjects, which sometimes consist of questions with follow-up (suggesting answers), sometimes consist of questions without follow-up, and sometimes are not in question format.

  It is not our intention that the model should supply answers to all the questions, for all subjects and sub-subjects. Indeed, in some cases we cannot provide these answers. Moreover, an approach using questions (with or without answers) is more appropriate for some sub-subjects than others. The objective is rather to build awareness of the questions and issues involved in ICT management so that the universities themselves are enabled to find their own answers that are appropriate to their specific circumstances.

  Similarly, we make reference to specific books and documents, selected from the vast range of literature available. We would encourage the universities to seek other references that might provide appropriate responses for these subjects and sub-subjects and thus support the universities in ICT management. A good
example of this is UoB’s proposal for the definition of ‘project management’. As UoB is aware of this sub-subject, it was able to find a suitable definition through a search of appropriate literature.

- UDSM considered that the terms ‘description’ (WHAT it is) and ‘prescription’ (WHAT to do and HOW to do it) create expectations that are not quite fulfilled, especially the term ‘prescription’.

Our response is that any expectations are clarified in Sections 11.4 and 11.5 where these terms are defined. Throughout the model these terms are used in accordance with the definitions given in 11.4 and 11.5.

- UDSM raised the question of strategic and tactical subjects and sub-subjects, such as ‘where does responsibility for ICT resources lie in the organizational structure?’ and ‘who owns strategic and tactical responsibility for these resources on behalf of the university?’

Our reply is that these responsibilities must be defined during the ICT strategic planning. Each university must decide on its own responses using the prescriptions. The model cannot take decisions for the universities. Application of the model will ensure that the universities take account of all relevant subjects and sub-subjects, but the response will differ from one university to another depending on factors such as the university’s size and geographical dispersion. Thus, the issues raised by UDSM are covered by the main subject ICT strategy.

- UDSM asks where the subject of ICT personnel is included, and wants our confirmation that ICT personnel can be part of ICT development/acquisition.

Our response is that specific activities relating to ICT personnel have to be undertaken mainly at the stage of ICT strategy, rather than at the later stage of ICT development/acquisition. Under ICT strategy, the sub-subjects education and research, management and administration, and general services are described in relation to the information systems to be established. From the theory of Information Systems, ICT Personnel are part of the Information Systems. If ICT personnel are not available at the time of ICT strategy design, they will have to be obtained by the university before an ICT development/acquisition process is initiated.

- UDSM raises the question of the need to link ICT with the overall planning of the University business.

In the definition of ICT strategy in Section 11.5.1, we point out that ICT strategy includes a vision of the application of ICT to education, research, management and administration and general services and how this vision is to be achieved, considering the personnel, technical and financial means which are available. By setting out such a vision, the university will be aligning its ICT strategy with the overall planning. This implies that the university may need to do some kind of ‘business re-engineering’ in order to exploit the full potential of ICT in the realization of its aims and objectives.

- UNISWA states that it is still trying to understand how the model provides support to the application of strategy, development/acquisition, implementation, utilization and service management. Nevertheless, in a previous statement UNISWA said that the model does create awareness for all the areas specified, and it should appeal more to top management who do not have a background in ICT.
Our response is that, in relation to the objective of the model (to create awareness and to provide support), the term 'support' should be understood as referring to the outlined subjects. Support is perceived as soon as the awareness is created, and the model can be utilized to give this support every time there is a need to deal with the outlined subjects.

With regard to the automated tool

- UDSM commented that the term 'automated tool' could lead the reader to think that forms or questionnaires would be elaborated in order to assist in the process of development of an ICT strategy. UNISWA stated that it had expected a system whereby certain variables could be entered in the model, and the output computed. UNAM considered that it would be more useful to provide a Big ICT Five module chart as a separate sheet to help the user understand the concept, and also suggested the addition of some graphics or some animated pictures to reflect the importance of the strategic modules.

Our reaction is that the automated tool is in fact a reflection of the conceptual model, aiming to give more value to the model through navigation. As the tool is available on the Internet, navigation allows users to gain access to and consult the model faster than they could if they were using a a book. In this respect, the comments made by UEM - that the pages are not too large to download and can be used by those with slow links - are very valid.

After these considerations, it was concluded that there was no need to make additions to the model and the automated tool. However, we expect that it will become necessary in future when suggestions for updating the content are made. This will be done as soon as new issues are raised, as described in Chapter 12.

13.7 Step 6: Conclusions regarding the validity of the research output

i. The universities in general have once again shown their interest in the results of the research by providing corrections/rectifications and additions to the chapters related to the assessment and by providing suggestions for Chapter 11 and the automated tool.

ii. In relation to the assessments, in general the universities agreed with our findings. It was noted that small changes/modifications have occurred during the lapse of time between the assessments and this validation, but the essence of the findings is valid. The changes may have been caused by (a) the dynamics of hardware, software and communications, (b) staff changes in the management of the computer centres and, in some universities, in top management. As this is the final version of the assessment, some universities paid more attention to our findings than they did in the early stages. We have checked all suggested corrections/rectifications and where appropriate have incorporated them in the final version of the assessments.

Our final comment on this is that the inventory of the technical infrastructures of the universities should be maintained and regularly updated, through configuration management. The need to keep track of frequent changes/modifications in ICT infrastructure should provide an incentive for the Computer Centres to ensure that ICT plans, and in particular ICT networking plans, are properly made and updated whenever necessary.

iii. In relation to the model, the universities have not made many comments. A substantive statement was made about how the model was useful for the creation of awareness and a point was made about the role that the model would play in
supporting the universities. Our comment is that the support provided by the
model will be more easily evaluated once awareness has been established and,
consequently, the Big ICT five are followed. In other words, the model will be
appreciated through its practical application. Nevertheless, the immediate
reactions of the universities to the model show their positive attitude towards its
eventual application.

iv. In relation to the automated tool, the various comments offered may be useful for
future research or may need to be considered in other stages of the tool’s
utilization. If the automated tool were required to provide an outcome based on
computed variables, this would completely change the meaning and the concept
of the model. Moreover, having a module chart, or adding graphics or some
automated pictures in the URL would require greater technical resources than are
available and would not be essential for the current research. Nevertheless, such
additions could be made without conceptual modifications. We believe that the
real technological restrictions on both the design and the utilization of the Big
ICT Five model will not hamper the achievement of its main objective.

Having analysed the comments received, we are convinced that the universities
are in agreement with the assessments, that the model is positively appreciated,
and that the automated tool can be utilized as alternative to the paper-based
model.
14. EPILOGUE

Introduction
The objective of this chapter is to present a summary of the research which was carried out and the author's experience of undertaking this research; conclusions regarding the research results and the utilization and application of the model and the automated system; and recommendations for five further research projects arising from the present research.

14.1 Summary of the Research Findings based on author's experience in this research

14.1.1 Exploration of the research problem

In all African countries except South Africa, developments in the field of Information and Communication Technologies (ICT) started much later than in Europe and other industrialized continents. Save a few exceptions, ICT only made an appearance on the African continent when the personal computer and local networks were introduced. Shortly after, there was an Internet boom. The universities and larger companies tend to lead the way in the application of ICT and have access to the rest of the world by means of the Internet. Many areas still do not have access to all kinds of automation applications. Very often there is no need for such applications, and there is a lack of knowledge and especially of financial means. Nevertheless ICT is gaining ground.

In Southern Africa, fourteen countries have united in the 'Southern African Development Community' (SADC), which addresses many issues, amongst them ICT and, particularly, telecommunications. At the same time, in the universities in the region many ICT developments in education, research, management and administration can be seen. ICT projects are quite common and a great variety of companies, individuals and foreign universities take part in these projects. Foreign institutes make this possible financially. African universities also use knowledge in the field of ICT obtained via external institutions, conferences and literature.

It cannot be denied that there is a lively interest in ICT in the universities. There is a strong urge to increase continually the number of personal computers. However, it is not possible to obtain a clear picture of how ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT service management are implemented in practice and to what extent the universities benefit from these. This was the conclusion drawn at a workshop in which high-level officials of the following universities participated:

- the University of Botswana
- the University of Dar Es Salaam in Tanzania
- the University Eduardo Mondlane in Mozambique
- the University of Namibia
- the University of Swaziland
- the University of Zambia

The participants found unanimously that the on-going investigation of the aspects of ICT strategy, development/acquisition, implementation, use and management was extremely relevant and recommended that a closer investigation be undertaken. Once they have the research results, the universities will determine how they wish to proceed. Together, the five ICT aspects were given the name 'big ICT five' in analogy to the African 'big five': the lion, the elephant, the leopard, the rhinoceros and the buffalo. This Doctoral thesis is the result of the research that followed the workshop. The research took place at the University Eduardo Mondlane at Maputo in Mozambique, under supervision from Delft University of Technology in Delft, the Netherlands.
14.1.2 The research approach

The research approach starts with a study of the management models that can be applied to discover how the aforementioned universities have interpreted the 'big ICT five' and how they deal with them. The following three management models were chosen for this purpose:

- the MCM paradigm
- the State Model, Extended State Model and MCM Model
- the Three Kinds of MCM model

Earlier research has proven these models suitable for showing systematically a number of aspects connected to the application, use and management of ICT.

Subsequently, for each model it was determined which subjects and objects were relevant and should be covered in order to give a complete picture of the current situation of the 'big ICT five'.

The MCM paradigm covers the following subjects and objects:

- the real system, and with regard to it
  its historical background
  its location(s)
  its internal organization
  its general services
  its administration
  its staff
  its situational factors

- the ICT, and especially
  complexity factors
  hardware/software characteristics
  database characteristics
  procedure characteristics
  the ICT management, and especially
  the internal organization
  the task areas/task fields
  the management processes
  the staff

- the internal relationships, and especially
  the relationships between the real system and the ICT
  the relationships between the ICT and the ICT management, and
  the relationships between the real system and the ICT management

- the external relationships

The State model/ the Extended State model covers the following subjects and objects:

- the university network and its states, tasks and processes
- the local area networks and their states, tasks and processes
- the general information systems, in terms of their states, tasks and processes

The Three Kinds of MCM model covers the following subjects:

- functional management, application management, and technical management, and for each:
  the internal organization
  the management tasks
  the management processes
  the procedures
14.1.3 Application of the management models

Applying the management models at the six universities proved to be a demanding process. It turned out that the required data could not be supplied directly. It took much effort to obtain these data. Besides correspondence by email, several visits to the universities concerned and consultations were necessary. Apart from the visits to the university of Swaziland, all visits involved travel by plane.

Finally six ‘mirrors’ were developed that the universities could use to get an overall picture of their ‘big ICT five’.

14.1.4 Conclusions based on the application of the management models

The investigation of the ICT of universities by means of the management models resulted in the following findings, amongst others:

- In all universities, ICT consists of a collection of different hardware, software, and communication facilities. At many locations, advanced ICT is available. Access to the Internet is available, but not on the same scale as in western European universities. Nor is the ICT evenly distributed. Local and personal initiatives, rather than university management initiative, often determine what ICT is applied.
- Many ICT subjects are covered insufficiently. At the operational level there is much freedom for individuals to implement, change and manage ICT on their own. Individual approaches often predominate over approaches from strategic viewpoints. The importance of ICT in education, research, management, administrative systems and services is generally recognized. The management considers a professional approach very desirable. At strategic, tactical and operational levels there is a need for integration of ICT subjects and a clear relationship between them rather than fragmented concepts.

On the basis of these and other findings a model has been developed that can be used as a tool to take the current ‘big ICT five’ to a higher level. It involves increasing awareness with regard to the relevance of the ‘big ICT five’, and obtaining more knowledge about the application of the ‘big ICT five’.

14.1.5 The model

The point of departure for the model is the following five main subjects: ICT strategy, ICT development/acquisition, ICT implementation, ICT utilization and ICT service management and the relationships between these.

Each main subject is first defined. Then it is described in more detail (the descriptive part), objectives and directives are given (the prescriptive part) which are important for the implementation. Some references to literature are given.

For each main subject five sub-subjects are described. Each sub-subject is defined, after which it is explained further (the descriptive part) and directives (the prescriptive part) for the implementation. The sub-subjects have been chosen based on familiarity from current practice to eliminate the existing problems. For each main subject the sub-subjects described are as follows:

- ICT strategy:
  - education and research
  - management and administration
  - general services
  - security
investments and costs
• ICT development/acquisition:
  development versus acquisition
  requirements and preconditions
  development process
  acquisition process
  selection process
• ICT implementation:
  project management
  end-user training
  management, control and maintenance training
  service level agreements
  testing
• ICT utilization:
  effectiveness and efficiency
  user skills
  management, control and maintenance relationships
  security awareness
  cost awareness
• ICT service management:
  three kinds of management, control and maintenance
  service support subjects
  service delivery subjects
  user relationships
  charging

14.1.6 The automated system

The second purpose of the research was the development of an automated system that is based on the model. For the development of the automated system, first an object-oriented architecture was developed. Then for the technical realization the client/server concept was used. For each university, the client consists of a set of computers which all have access to the Internet. The server is a computer belonging to the University Eduardo Mondlane in Mozambique. On the server the architecture of the model and the content of all the main subjects and sub-subjects and their interrelations have been stored. Each university has a password to gain access to the server. The University Eduardo Mondlane is the manager of the system. Proposals to change or supplement subjects must be submitted to the system manager.

To realize the system the following computer languages have been used, among others: HTML (Hypertext Markup Language), mySQL DBMS (my SQL Data Base Management System), CMS (Content Management System), SQL (Structured Query Language) and PHP (scripting language for WEB programming). It is a menu-driven system with navigation between the main subjects and the sub-subjects.

14.2 Conclusion with regard to the research results and the utilization and application of the model and the automated system

All universities were presented with the model and the system. They were asked to report their findings on the final products of the research project, based on certain points of interest. They were reminded of the original objective, namely:
• to develop a model and an automated system based on it in order to obtain more knowledge on the subjects: ICT strategy, ICT development/
acquisition, ICT implementation, ICT utilization and ICT service management; and subsequently
• to interpret them in such a way that the ICT contributes to the realization of the objectives of the organization with regard to education, research, management, administration and general services. The comments of the universities can be summarized as follows:

Each university only suggested some minor corrections; otherwise they agreed fully with the research results obtained with the aid of the management models.

With regard to the application of the model the universities responded positively. Some additional information was given on the content of the subjects.

The universities responded differently with respect to the application of the automated system, in addition to or instead of the model: some considered it a benefit, while others did not really notice a difference. However, the remarks made clear that extension of the automated system will be appreciated.

14.3 Recommendations for further research

This recommendation concerns the performance of applied research, especially research that will result in knowledge and products that will directly benefit institutions and companies which apply ICT in their primary and secondary processes. Five research projects are recommended, focusing on the following areas:
• the organizational and technical aspects with regard to security and protection;
• the effectiveness and efficiency of ICT application, ICT management and ICT maintenance;
• the size of and proportion between the investments, costs and benefits;
• the standardization of hardware, software and networks;
• the extension of the automated system with case studies.
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http://www.unam.na
http://uneeca.org
http://www.uniswa.sz
http://www.unza.zm
http://www3.sn.apc.org/Africa
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mvogels@nuffic.nl
### ANNEX 1 - LIST OF PARTICIPANTS TO THE WORKSHOP ON MANAGEMENT AND CONTROL OF ICT IN INSTITUTIONS OF HIGHER EDUCATION IN SOUTHERN AFRICA

<table>
<thead>
<tr>
<th>Nr</th>
<th>Name</th>
<th>University</th>
<th>Position</th>
<th>Contact</th>
</tr>
</thead>
</table>
| 1. | Prof. Mutale W. Chanda| UNZA       | Vice Chancellor                                   | E-mail: vc@admin.unza.zm  
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| 8. | Prof. Beda M. Mutagahywa| UDSM    | Director, University Computer Centre             | E-mail: jmhoma@avu.org  
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| 12. | Prof. Dr. M. Loviën   | TU Delft   | Doctorate Promoter                                | E-mail: m.loviën@tw.tudelft.nl  
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ANNEX 2 - THE LETTER SENT TO THE SIX UNIVERSITIES

Venâncio Massingue
University Eduardo Mondlane
C.P. 257
Maputo - Mozambique

To: Vice Chancellor or
Deputy Vice-Chancellor

C/O:
Director of IT Centre

Subject: Request for your collaboration in the validation of three chapters of my PhD
Thesis, entitled: Building awareness and support to ICT management in
African Universities.

My thesis on building awareness and support to ICT management in African Universities is
nearing completion.

You will recall that on 25th March 2000, we held a workshop in Maputo at which your
university was represented by [INSERT NAMES OF REPRESENTATIVES].

At the workshop, the proposition for the thesis was agreed [STATE PROPOSITION]. It was
also agreed that the thesis should include an assessment of ICT management in the six
universities represented (Botswana, Dar-Es-Salaam, Eduardo Mondlane, Namibia, Swaziland
and Zambia). This assessment was based on information collected at the workshop, and also
through visits to all the universities, exchange of materials at various international
conferences, and exchange of e-mails.

The assessments of the six universities are now complete and, based on the results, I have
developed a conceptual model which aims to build awareness of the need for ICT
management and to provide skills and knowledge for such management. I have also
developed an Internet-based automated tool to assist in the practical application of the
conceptual model.

I attach for your attention Chapter X of the thesis, which contains the assessment of your
university, Chapter 11: “The Big ICT Five Conceptual Model”, and Chapter 12, which is the
automated tool and can also be found at http://www.bigictfive.uem.mz

Note: To access the automated tool in the Internet, please use the following user name and
account:

User name: university
Password: 100basse

These extracts represent the final formulation of the thesis and it is not intended that they will
be changed.
Annex 2

I would now like to request your collaboration in the validation of the thesis and the model, by answering the following questions:

i. In relation to Chapter X,

   a) Are there any significant omissions or errors in this assessment?

ii. In relation to Chapter 11 (the conceptual model):

   a) Is Chapter 11 easy to read for the potential users of the conceptual model (in terms of layout and language used)?

   b) Is Chapter 11 understandable to the potential users of the conceptual model (in terms of clarity of expression)?

   c) Does the model create awareness concerning:
      - ICT strategy?
      - ICT development/acquisition?
      - ICT implementation?
      - ICT utilization?
      - ICT service management?

   d) Does the model provide support to the application of:
      - ICT strategy?
      - ICT development/acquisition?
      - ICT implementation?
      - ICT utilization?
      - ICT service management?

iii. In relation to the automated tool (Chapter 12 and http://www.bigictfive.uem.mz):

   a) Is the automated tool easy to use (navigate)?

   b) Does it give extra value to the conceptual model compared with the written form of the model?

In the long process of my research, what I have achieved so far has been thanks to your cooperation and guidance on specific issues relating to your university. I would much appreciate your continued support, and would be very grateful if you would provide me with your answers to the questions stated above within the next 15 days. This will help me to conclude my thesis and to submit the concept to the Doctoral Examination Committee of TUDelft for appraisal.

Thank you in advance for your support,

Yours sincerely,
Venâncio Massingue
ANNEX 3 - PRESENTATION OF THE RESPONSES RECEIVED FROM THE SIX UNIVERSITIES

The following tables present the responses as they were given by the universities to the questions contained in the letter sent to each one.

<table>
<thead>
<tr>
<th>University of Botswana (UoB) - Botswana</th>
<th>Recalling for question</th>
<th>Answer received</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. in relation to the University Assessment</td>
<td>Are there any significant omissions or errors in this assessment?</td>
<td>• DVC’s comment is that information has been overtaken by events. I think of particular interest is the change in management. I have left it as is because that was the situation at the time of the investigation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Corrections on the tables. Some functions were left out, but are being undertaken. Further comments in text.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The Chapter taken an Auditor’s approach. Tends to point more of what is not in place and has deafening silence about what is in place. It must be appreciated that whilst the existing structure/approach may not necessarily fit into your model, there are procedures in place and are fit for the purpose. More comments on the text.</td>
</tr>
</tbody>
</table>

|                                           | a) Is Chapter 11 easy to read (in terms of layout and language used)? | • The use of sub-subject is quite confusing. While there is consistency in the maintenance of predominantly five topics within a “subject”, the use of the word sub-subject is quite unusual and may not be easily understood by the reader. It must be pointed out that the level of consistency is quite appealing. |
|                                           |                       | • As pointed out above, the write-up is consistent, so once one gets to understand the approach, it is easier to follow afterwards. |

|                                           | b) Is Chapter 11 understandable (in terms of clarity of expression)? | • A title problem arises with consistency when questions are encountered. At the beginning, one tends to expect that what follows is an attempt to provide answers (an approach/methodology) to those questions. In some instances, an attempt is made to follow on those questions. For instance, 11.5.2 – ICT Development/Acquisition: under prescriptions is a number of questions. At first glance, one tends to expect answers to those questions. What follows is a discussion about what would normally follow once answers to those questions have been obtained. |
### Annex 3

<table>
<thead>
<tr>
<th>Recalling for question</th>
<th>Answer received</th>
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</thead>
</table>
| b) Is Chapter 11 understandable (in terms of clarity of expression)? | - Contrast the discussion that follows in the above-quoted section with section 11.6.3.1: Project Management. A definition of a Project is provided, although the answer to WHY project management is not provided (an attempt to answer the question is provided in the edition chapter). Immediately after the questions in this section, the discussion does not follow the same pattern as that of section 11.6.2. In other words, there is no smooth flow from the questions to the processes discussed under the umbrella "project management". One would expect something that links the two in the form of saying something like "once the time, scope and cost (see edition chapter 11) have been determined, the following distinct project management processes are undertaken...."  
- The approach taken in section 11.6.4.1 seems not to raise expectations, is subtle but still drives home the same message that there are issues to pay attention to without putting it in question format. |
| c) Does the model create awareness concerning:  
  - ICT strategy?  
  - ICT development/acquisition?  
  - ICT implementation?  
  - ICT utilization?  
  - ICT service management? | Yes to all |
| d) Does the model provide support to the application of:  
  - ICT strategy?  
  - ICT development/acquisition?  
  - ICT implementation?  
  - ICT utilization?  
  - ICT service management? | Yes to all |

### iii. In relation to the automated tool (http://www.bigfive.ub.wf) |
| a) Is the automated tool easy to use (navigate)? |  |
| b) Does it give extra value to the conceptual model compared with the written form of the model? |  |

Answered by Mr. Ratsela Moketsi (moketsi@moipi.ub.bw)  
Director of IT Centre, University of Botswana
### Annex 3

**University of Dar Es Salaam (UDSM) – Tanzania**

<table>
<thead>
<tr>
<th>Recalling for question</th>
<th>Answer received</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. In relation to the University Assessment</td>
<td>I found the two chapters and the web version very informative, easy to read and practical. I will make changes in the text of chapter 6 to indicate what I think should be changed or looked at.</td>
</tr>
<tr>
<td>Are there any significant omissions or errors in this assessment?</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>a) Is Chapter 11 easy to read (in terms of layout and language used)?</th>
<th>Yes, I find quite easy to read.</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) Is Chapter 11 understandable (in terms of clarity of expression)?</td>
<td>Yes overall. The two terms; description and prescription used give rise to some kind of expectation which is not quite justified...especially prescription. (how ever I don’t have a better proposal)</td>
</tr>
<tr>
<td>c) Does the model create awareness concerning:</td>
<td>ICT organization needs to be placed in perspectives at the strategic level. Questions like where does ICT resources responsibility lie in the organizational structure and who owns strategic and tactical responsibility for these resources on behalf of the organization (University) Are the ICT personnel included here and could this be the case for both acquisition and development.</td>
</tr>
<tr>
<td>• ICT strategy?</td>
<td></td>
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<tr>
<td>• ICT development/acquisition?</td>
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<td>• ICT implementation?</td>
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<td>• ICT utilization?</td>
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<td>• ICT service management?</td>
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<tr>
<th>d) Does the model provide support to the application of:</th>
<th>One thing which I am sure is dealt with in other areas is the linking of ICT utilization with certain kind of business re-engineering, and some how linking ICT with the overall planning of University business</th>
</tr>
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<tbody>
<tr>
<td>• ICT strategy?</td>
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<td>• ICT development/acquisition?</td>
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<td>• ICT implementation?</td>
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<td>• ICT service management?</td>
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<tr>
<th>ii. In relation to the Conceptual Model</th>
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<tr>
<th>a) Is the automated tool easy to use (navigate)?</th>
<th>Yes to navigate</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) Does it give extra value to the conceptual model compared with the written form of the model?</td>
<td>Again here the use of the term ‘automated tool’ creates expectations of some kind. For example one is lead to think of forms or questionnaires to assist in the process of developing a strategy...etc.</td>
</tr>
</tbody>
</table>

Answered by: Prof. Beda Mutagihwa, UCC Director, kmudap@udsm.ac.tz
### Annex 3

<table>
<thead>
<tr>
<th>University Eduardo Mondlane (UEM) - Mozambique</th>
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<tbody>
<tr>
<td><strong>Recalling for question</strong></td>
</tr>
<tr>
<td>i. In relation to the University Assessment</td>
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<td>ii. In relation to the Conceptual Model</td>
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<tr>
<td>iii. In relation to the automated tool (<a href="http://www.bigictfiveuem.mz">http://www.bigictfiveuem.mz</a>)</td>
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<td>Answered by</td>
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</table>
### Table of Responses - University of Namibia (UNAM) – Namibia

<table>
<thead>
<tr>
<th>The question recalled</th>
<th>Answer received</th>
</tr>
</thead>
</table>
| **i. In relation to the University Assessment** | 1. It covers detail information and activities of computer center and implementation ICT strategy. In page 10, Figure 8.3.1, I felt that the individual names are not required in the organization chart. Only the designation and flow is enough.  
2. In page no 15, and sub title 8.6, I found that the Hostel Maintenance and mess for the students is not covered. Our existing software covers the hostel students maintenance record as well as the kitchen and mess billing system. Other wise chapter 8 is very fine. |
| Are there any significant omissions or errors in this assessment? | |

| **ii. In relation to the Conceptual Model** | **a)** Is Chapter 11 easy to read (in terms of layout and language used)?  
**b)** Is Chapter 11 understandable (in terms of clarity of expression)?  
**c)** Does the model create awareness concerning:  
- ICT strategy?  
- ICT development/acquisition?  
- ICT implementation?  
- ICT utilization?  
- ICT service management?  
**d)** Does the model provide support to the application of:  
- ICT strategy?  
- ICT development/acquisition?  
- ICT implementation?  
- ICT utilization?  
- ICT service management? | **The language used is very simple and can be easily understandable by a common man and the flow of contents is fine.**  
**The clarity and expression mentioned in each sub chapters is good.**  
**Model gives complete awareness of all five modules of ICT.**  
**The model provides a good support to the application and also to expand the ICT model to the required level.** |

| **iii. In relation to the automated tool (http://www.bigictfive.unam.na)** | **a)** Is the automated tool easy to use (navigate)?  
**b)** Does it give extra value to the conceptual model compared with the written form of the model? | **Any one can easily navigate the website by using URL address.**  
**In my opinion it would have been better if you give a big five ICT module chart as a separate sheet so that the user can easily understand the concept. In the existing one it is very difficult to read the chart.**  
**It is too much of theory one should have got some patience to go through in detail. My suggestion is that, if you add some graphics or some animated picture to reflect the importance of strategic modules it will give added colour to your URL.**  
**Over all the two chapters and the automated tool gives a good idea and the coverage of ICT planning and development strategy in detail with respect to utilization and implementation.** |

Answered by  
Suresh K S, ksuresh@unam.na  
Manager of the Computer Center, University of Namibia
# Table of Responses - University of Swaziland (UNISWA) – Swaziland

<table>
<thead>
<tr>
<th>The question recalled</th>
<th>Answer received</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. In relation to the University Assessment</td>
<td>Are there any significant omissions or errors in this assessment?</td>
</tr>
<tr>
<td></td>
<td>On page 2 of the chapter, in the Mintzberg logo, there are 4 personnel in the ICT Lab instead of the 5 shown. (minor error)</td>
</tr>
<tr>
<td></td>
<td>On page 3 under Administration supporting education, research and services, the vice chancellor is a female, hence references to her should be either be her or she.</td>
</tr>
<tr>
<td></td>
<td>On page 5, under five year ICT strategic plan, item (1), it should be (student records information system and the personnel information system).</td>
</tr>
<tr>
<td></td>
<td>On page 6, under People, it should read: Numbers. 295 academic and administrative staff and 513 support and clerical staff.</td>
</tr>
<tr>
<td></td>
<td>On page 6, the Database management software is dBASE IV instead of Oracle. Besides the above-mentioned minor mistakes, the information in Chapter 9 reflects the situation that was happening at UNISWA when the research was being carried out.</td>
</tr>
<tr>
<td>ii. In relation to the Conceptual Model</td>
<td>a) Is Chapter 11 easy to read (in terms of layout and language used)?</td>
</tr>
<tr>
<td></td>
<td>Yes the chapter is easy to read, especially for administrators who are not familiar with ICT.</td>
</tr>
<tr>
<td></td>
<td>b) Is Chapter 11 understandable (in terms of clarity of expression)?</td>
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<tr>
<td></td>
<td>The chapter is understandable</td>
</tr>
<tr>
<td></td>
<td>c) Does the model create awareness concerning:</td>
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<tr>
<td></td>
<td>• ICT strategy?</td>
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<td>• ICT development/acquisition?</td>
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<td>• ICT utilization?</td>
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<td></td>
<td>• ICT service management?</td>
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<td></td>
<td>The model does create awareness for all the areas specified, and it should appeal more to top management who do not have a background in ICT.</td>
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<td></td>
<td>d) Does the model provide support to the application of:</td>
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<td>• ICT strategy?</td>
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<tr>
<td></td>
<td>• ICT development/acquisition?</td>
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<td>• ICT utilization?</td>
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<td></td>
<td>• ICT service management?</td>
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<td></td>
<td>I am presently still trying to understand how the model provides support to the application of strategy, development/acquisitions, implementation, utilizations and service management.</td>
</tr>
<tr>
<td>iii. In relation to the automated tool (<a href="http://www.bisicfive.uem.mz">http://www.bisicfive.uem.mz</a>)</td>
<td>a) Is the automated tool easy to use (navigate)?</td>
</tr>
<tr>
<td></td>
<td>The tool is easy to navigate, although I would have expected a system whereby you enter certain variables, and the output is computed.</td>
</tr>
<tr>
<td></td>
<td>b) Does it give extra value to the conceptual model compared with the written form of the model?</td>
</tr>
<tr>
<td></td>
<td>from what I have seen, the model looks like a written form of the conceptual model.</td>
</tr>
</tbody>
</table>

**Answered by**

Thembela Thwala, ththwala@uniswa.sz
Acting ICT Centre Director, University of Swaziland
<table>
<thead>
<tr>
<th>Table of Responses - University of Zambia (UNZA) – Zambia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The question recalled</strong></td>
</tr>
<tr>
<td>i. In relation to the University Assessment</td>
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Answered by

Mr. John Munsaka, jmunsaka@cc.unza.zm
Director - Computer Centre, University of Zambia
SAMENVATTING (NEDERLANDS)

1. Verkenning van het onderzoeksgebied


Het valt niet te ontkennen dat de ICT binnen de universiteiten grote belangstelling geniet. Er is een sterke drang om vooral het aantal personal computers voortdurend op te voeren. De wijze waarop invulling wordt gegeven aan ICT-strategie, ICT-ontwikkeling/aanschaf, ICT-implementatie, ICT-gebruik en ICT-beheer en de mate waarin dit alles de universiteiten ten goede komt is niet te overzien. Dat blijkt uit een workshop waaraan werd deelgenomen door het management van de volgende universiteiten:
- de Universiteit van Botswana
- de Universiteit van Dar es Salaam in Tanzania
- de Eduardo Mondlane Universiteit in Mozambique
- de Universiteit van Namibië
- de Universiteit van Swaziland
- de Universiteit van Zambia

Unaniem was men de mening toegedaan dat het van groot nut is om de onderwerpen strategie, ontwikkeling/aanschaf, implementatie, gebruik en beheer met betrekking tot ICT nader te onderzoeken. Afhankelijk van de onderzoeksresultaten dient dan te worden vastgesteld hoe men met die onderwerpen verder wenst te gaan. De vijf onderwerpen vat men samen onder de naam de ‘big ICT five’ naar analogie van de Afrikaanse ‘big five’: de leeuw, de olifant, het jachtluipaard, de rinoceros en de buffel.

2. De onderzoeksaanpak

De onderzoeksaanpak begint met de bestudering van beheermodellen die zijn toe te passen voor het in beeld brengen van de manier waarop de genoemde universiteiten de ‘big ICT five’ hebben ingevuld en ermee omgaan. De keuze viel op de volgende drie beheermodellen:
- het Beheerparadigma
- het Toestandenmodel/het uitgebreid toestandmodel
- het Dreivoudig model van beheer

Het betreft modellen waarvan bij eerdere onderzoeken is bewezen dat zij geschikt zijn om tal van aspecten rond de ontwikkeling, het gebruik en het beheer van ICT systematisch in beeld te brengen.

Van elk model is vervolgens vastgesteld wat relevant is om bij de toepassing van de modellen te betrekken teneinde de huidige situatie van de ‘big ICT five’ in beeld te brengen.

Het Beheerparadigma reikt het volgende aan:
- het reële systeem en met name daarvan
  - enige historische achtergrond
  - de lokatie(s)
  - de interne organisatie
  - de algemene diensten
  - de administraties
  - de medewerkers
  - situationele factoren
- de ICT en met name daarvan
  - de complexiteitsfactoren
  - apparaatuur/programmatuur karakteristieken
  - database karakteristieken
  - procedure karakteristieken
- het ICT beheer en met name daarvan
  - de interne organisatie
  - de taakgebieden/taakvelden
  - de beheerprocessen
  - de medewerkers
- de interne relaties en met name
  - de relaties tussen het reële systeem en de ICT
  - de relaties tussen de ICT en het ICT beheer en
  - de relaties tussen het reële systeem en het ICT beheer
- de externe relaties

Het Toestandenmodel/het uitgebreid toestandenmodel reikt het volgende aan:
- het universiteitsnetwerk met betrekking tot toestanden, taken en processen
- de lokale netwerken met betrekking tot toestanden, taken en processen
- de algemene universiteitsinformatiesystemen met betrekking tot toestanden,
- taken en processen
Samenvatting (Nederlands)

Het Drievoudig model van beheer reikt het volgende aan:
- het functioneel beheer, het applicatiebeheer, het technisch beheer en van elk
de interne organisatie
de beheertaken
de beheerprocessen
de procedures
de medewerkers

3. Toepassing van de beheermodellen

De toepassing van de beheermodellen bij de zes universiteiten was een intensief proces. Directe oplevering van de gevraagde gegevens bleek te zijn uitgesloten. Veel inspanning was daarom nodig om de gegevens te verkrijgen. Naast contacten via e-mail waren diverse plaatselijke bezoeken en overleg noodzakelijk. Op één universiteit na, de universiteit van Swaziland, gingen alle bezoeken vanwege de grote afstanden gepaard met vliegreizen.

Uiteindelijk werden als het ware zes spiegels verkregen waarmee de universiteiten voor het eerst een totaal beeld kregen van hun ‘big ICT five’.

4. Conclusies op basis van de toepassing van de beheermodellen

Het doorlichten van de universiteiten met behulp van de beheermodellen leidde ondermeer tot de volgende waarnemingen:
- ICT is bij alle universiteiten een verzameling van uiteenlopende apparatuur, programmaatuur en communicatiefaciliteiten. Geavanceerde ICT is op veel locaties voorhanden. Toegang tot Internet is aanwezig maar niet in die mate zoals bij West Europese universiteiten. Evenmin is er sprake van een evenwichtige spreiding van de ICT. Lokale en persoonlijke initiatieven zijn vaak meer bepalend voor een ICT-invulling dan een overkoepelend management-initiatief.
- Een groot aantal ICT-onderwerpen wordt onvoldoende verstaan. Op operationeel niveau bestaat aanzienlijke vrijheid om zelf te implementeren, te wijzigen en te beheren. Vaak is er sprake van individuele benaderingen en minder van een aanpak vanuit strategische gezichtspunten.

Op basis van deze en andere waarnemingen is een beschrijvend en voorschrijvend model ontwikkeld ter vergroting van de bewustwording ten aanzien van de relevantie van de ‘big ICT five’, alsook ter verkrijging van meer kennis ten aanzien van de toepassing van de ‘big ICT five’. Dat maakt dat het model een hulpmiddel is om de ‘big ICT five’ naar een hoger niveau te brengen.

5. Het model

Elk hoofdonderwerp wordt eerst gedefinieerd. Daarop volgt een meer gedetailleerde beschrijving (het beschrijvende gedeelte), voorschriften en aanwijzingen (het voorschrijvende gedeelte) die bij implementatie van het hoofdonderwerp belang zijn. Naar enige literatuur wordt gerefereerd om het onderwerp nog beter te leren kennen. Op elk hoofdonderwerp volgen vijf deelonderwerpen. Elk deelonderwerp is gedefinieerd en wordt gevolgd door nadere uitleg (het beschrijvende gedeelte) en voorschriften (het voorschrijvende gedeelte) ten behoeve van implementatie. De deelonderwerpen zijn gekozen op goede herkenbaarheid in de praktijk en om zodoende de huidige tekortkomingen te elimineren. Per hoofdonderwerp betreft het de volgende deelonderwerpen:

- **ICT-strategie:**
  - onderwijs en onderzoek
  - management en administratie
  - algemene diensten
  - beveiliging
  - investeringen en kosten

- **ICT-ontwikkeling/aanschaf:**
  - ontwikkeling versus aanschaf
  - eisen en randvoorwaarden
  - ontwikkelingsproces
  - aanschafproces
  - selectieproces

- **ICT-implementatie:**
  - project management
  - gebruikerstraining
  - beheerderstraining
  - service level agreements
  - testen

- **ICT-gebruik:**
  - effectiviteit en efficiëntie
  - gebruikerskennis
  - beheerrelaties
  - beveiligingsbewustwording
  - kosten-bewustwording

- **ICT-beheer:**
  - drie vormen van beheer
  - beheerprocessen-1
  - beheerprocessen-2
  - gebruikersrelaties
  - doorberekening

6. **Het geautomatiseerde systeem**

Het tweede doel van het onderzoek was het ontwikkelen van een geheel op het model gebaseerd geautomatiseerd systeem. Daarvoor is eerst een object-georiënteerde architectuur ontworpen. Vervolgens is voor de technische realisatie uitgegaan van het client/server concept. De client omvat voor elke universiteit een set computers die alle toegang tot Internet...
Samenvatting (Nederlands)

hebben via een Web browser. De server is een computer die toehoort aan de Eduardo Mondlane Universiteit van Mozambique. Op de server bevindt zich de architectuur van het model en de inhoud van alle hoofdonderwerpen en deelonderwerpen met hun onderlinge relaties. Elke universiteit heeft zijn eigen autorisatie om toegang tot de server te krijgen. De Eduardo Mondlane Universiteit is de beheerder van het systeem.

Voorstellen om onderwerpen te wijzigen of aan te vullen verlopen via de beheerder. Voor de realisatie van het systeem is ondermeer gebruik gemaakt van HTML (Hypertext Markup Language), mySQL DBMS (my SQL Data Base Management System), CMS (Content Management System), SQL (Structured Query Language) en PHP (scripting language for WEB programmning). Het gebruik van het systeem is menugestuurd met navigatie tussen de hoofdonderwerpen en deelonderwerpen.

7. Conclusies met betrekking tot de onderzoeksresultaten en het gebruik en de toepassing van het model en het geautomatiseerde systeem

Alle universiteiten zijn geconfronteerd met het model en het systeem. Hen is gevraagd om aan de hand van aandachtspunten hun bevindingen te geven over de eindprodukten van het onderzoek. Ze zijn herinnerd aan de oorspronkelijke doelstelling, namelijk:
- een model en een daarop gebaseerd geautomatiseerd systeem te ontwikkelen om:
  de onderwerpen ICT-strategie, ICT-ontwikkeling/aanschaf, ICT-implementatie,
  ICT-gebruik en het ICT-beheer beter te leren kennen
- en vervolgens daaraan een invulling te geven die bijdraagt aan de realisatie van de doelstelling van de organisatie met betrekking tot ICT in onderwijs, onderzoek, management, administratie en algemene dienstverlening.

Het commentaar van de universiteiten is als volgt samen te vatten:
Elke universiteit stemde, behoudens het aanbrengen van kleine correcties, in met de onderzoeksresultaten zoals die met behulp van de beheermodellen waren verwoord.
Met betrekking tot de toepassing van het model was men positief. Een enkele aanvulling werd gegeven op de inhoud van de onderwerpen.
De toepassing van het geautomatiseerde systeem, naast of in plaats van het model, werd verschillend beoordeeld. Voor de een was het meerwaarde, voor de ander was er geen echt verschil. Uit de opmerkingen kon worden geconcludeerd dat uitbreiding van het geautomatiseerde systeem, met ondermeer implementaties van deelonderwerpen in de praktijk, van groot belang wordt geacht.

8. Aanbevelingen voor verder onderzoek

De aanbeveling betreft het verrichten van toegepast onderzoek. Het gaat hier in het bijzonder om onderzoek dat resulteert in kennis en producten die direct ten goede kunnen komen aan instellingen en bedrijven die ICT toepassen in hun primaire en secundaire processen. Derhalve dient dit onderzoek zich te richten op:
- de organisatorische en technische aspecten met betrekking tot veiligheid en beveiliging;
- de effectiviteit en de efficientie van ICT toepassen, ICT beheren en ICT onderhouden;
- grootte en de verhouding tussen investeringen, kosten en baten;
- de standaardisatie van apparatuur, programmatuur en netwerken;
- de uitbreiding van het geautomatiseerde systeem met case studies.
About the Author

ABOUT THE AUTHOR

Venâncio Massingue was born in 1960 in Chibuto district, Mozambique. In 1968 he left the district to complete his schooling in the capital Maputo (formerly Lourenço Marques). After qualifying as an electronic and electrical engineering technician in 1982, he was selected to work in the newly-established Informatics Centre (CIUEM) at Eduardo Mondlane University (UEM) and attended professional training courses in computer hardware in the UK and the Netherlands.

From 1987 to 1992, he studied for the degree of Licenciatura in electro-technical engineering at UEM, with thesis research work done at TUDelft. At the same time, he worked as Head of the Computer Maintenance Department and, later, Deputy Director of CIUEM.

After his graduation, he was appointed Director of CIUEM and, from this position, was a key player in bringing the Internet to Mozambique and in developing CIUEM as a centre of expertise for South-South cooperation programmes, with the assistance of TUDelft within framework of the MHO programme.

From 1996 to 1998 he masterminded the development of the Mozambique ICT Policy and ICT Strategy that were later approved by the Cabinet in 2000 and 2002 respectively. Presently he is a member of Mozambican Informatics Policy Task Force for Development of a National Information Policy.

Since 1997 he has been Vice-Rector for Administration & Resources and Information & Communications Technologies at UEM, and is currently involved in the conception and development of a Mozambican Institute for Science and Technology (MICTI). He lectures the discipline of Data Communications and Networks in the Department of Mathematics and Informatics of UEM.

From 1996 to 2000 he served on many national and international committees concerned with ICT, including the African Technical Advisory Committee (ATAC) of the African Information Society Initiative (AISI) of UN-ECA, and the UNESCO Intergovernmental Informatics Programme. Currently he is the president of the UNESCO Regional Informatics for Africa (RINAf). He has published a number of articles and publications in the field of ICT for national, regional and international institutions and organizations.

In 1998, he received the UNESCO Albert Einstein Medal for Science and Technology.

Seeking to broaden his field of expertise, he has recently attended courses in Economic Concepts for Engineers and Managers at MIT, USA (June 2002) and in Human Resource Development and Academia-Industry Cooperation on ICT in Japanese Universities (2003), in Japan.

He is married, with two daughters.
## INDEX OF AUTHORS

<table>
<thead>
<tr>
<th>Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ade Ajayi J.F.</td>
<td>279</td>
</tr>
<tr>
<td>Adeya, Catherine Nyakti</td>
<td>279</td>
</tr>
<tr>
<td>African Development Forum</td>
<td>279</td>
</tr>
<tr>
<td>Akhtar, S.</td>
<td>279</td>
</tr>
<tr>
<td>Andreu, R.</td>
<td>279</td>
</tr>
<tr>
<td>Applegate, Lynda M.</td>
<td>279</td>
</tr>
<tr>
<td>Avison, D.E.</td>
<td>279</td>
</tr>
<tr>
<td>Bartee, Thomas C.</td>
<td>279</td>
</tr>
<tr>
<td>Batini, Carlo.</td>
<td>279</td>
</tr>
<tr>
<td>Bekke, J.H. ter.</td>
<td>279</td>
</tr>
<tr>
<td>Ben Barka, Lalla</td>
<td>279</td>
</tr>
<tr>
<td>Benbasat, I.</td>
<td>279</td>
</tr>
<tr>
<td>Berghout, Egon</td>
<td>285</td>
</tr>
<tr>
<td>Blewett, C.N.</td>
<td>280</td>
</tr>
<tr>
<td>BMI TechKnowledge</td>
<td>13, 68, 279</td>
</tr>
<tr>
<td>Boman, Magnus.</td>
<td>280</td>
</tr>
<tr>
<td>Booch, Grady</td>
<td>222, 223, 280</td>
</tr>
<tr>
<td>Bon, Jan van.</td>
<td>225, 280</td>
</tr>
<tr>
<td>Browne, Peter</td>
<td>6, 280</td>
</tr>
<tr>
<td>Bubenko Janis A. Jr.</td>
<td>280</td>
</tr>
<tr>
<td>Burke, Rory</td>
<td>280</td>
</tr>
<tr>
<td>Caelli, William</td>
<td>280</td>
</tr>
<tr>
<td>Camara, Alioune Badara</td>
<td>9, 280</td>
</tr>
<tr>
<td>Casson, Mark</td>
<td>280</td>
</tr>
<tr>
<td>Art Caston</td>
<td>285</td>
</tr>
<tr>
<td>CCTA</td>
<td>223, 224, 280</td>
</tr>
<tr>
<td>Center for International Development at Harvard University</td>
<td>67, 94, 122, 150, 175, 202, 279, 281</td>
</tr>
<tr>
<td>Ceri, Stefano</td>
<td>279</td>
</tr>
<tr>
<td>Coad, P.</td>
<td>243, 280</td>
</tr>
<tr>
<td>Commonwealth Regional Health Community Secretariat</td>
<td>280</td>
</tr>
<tr>
<td>Consortium EXIN, FAST, ID Research, SEMA, TIEKE</td>
<td>280</td>
</tr>
<tr>
<td>DAE</td>
<td>281</td>
</tr>
<tr>
<td>Denzin N. K.</td>
<td>19, 280</td>
</tr>
<tr>
<td>Dorn, Harold</td>
<td>283</td>
</tr>
<tr>
<td>Earl, Michael J.</td>
<td>221, 280</td>
</tr>
<tr>
<td>Eisenhardt, K. M.</td>
<td>19, 280</td>
</tr>
<tr>
<td>Eisenstadt, Marc</td>
<td>280</td>
</tr>
<tr>
<td>Elbert, Bruce R.</td>
<td>280</td>
</tr>
<tr>
<td>Engelien, Brigitte</td>
<td>284</td>
</tr>
<tr>
<td>Erwin, G. J.</td>
<td>280</td>
</tr>
</tbody>
</table>
Index of authors

F
Feeny, D..............................................................................................................221, 287
Feit, Sidnie...........................................................................................................280
Fishwick, Paul A....................................................................................................281
Fitzgerald, G.........................................................................................................279

G
Gamma, Erich........................................................................................................281
Gavin, Terry.........................................................................................................6, 280
Global Information Infrastructure Commission.................................................281
Goldstein, D.K.......................................................................................................279
Goma, Lameck K.H..............................................................................................279
Graves, William H.................................................................................................281
Greenbaum, David A............................................................................................281
Grembergen, Wim van..........................................................................................281
Gupta, Amar..........................................................................................................281

H
Harker, Jonathan.....................................................................................................281
Harris, Ray..............................................................................................................281
Helgeson, Donald V...............................................................................................281
Helm, Richard.........................................................................................................281
Hudson, Mike.........................................................................................................281
Hunt, Craig..............................................................................................................281

I
Ibrahim, Aminu.......................................................................................................281
Ingoldsbys, Timothy C..........................................................................................281
International Development Research Centre (IDRC)..........................................282
Islei, G....................................................................................................................221, 287

J
James, Tina..............................................................................................................282
Jensen, Michael......................................................................................................282
Johannesson, Paul...................................................................................................282
Johnson, G. Ampah...............................................................................................279
Johnson, Ivar..........................................................................................................280
Johnson, Ralph.......................................................................................................281

K
Kaplan, Robert S....................................................................................................282

L
LaQuey, Tracy .......................................................................................................282
Laudon, Jane P........................................................................................................282
Laudon, Kenneth C.................................................................................................282
Leedy, Paul D..........................................................................................................282
Levey, Lisbeth A......................................................................................................282
Lincoln, Y.S..........................................................................................................19, 280
Longley, Dennis....................................................................................................280
Looijen, M.................................................................................................................20, 33, 37, 44, 215, 225, 282
Lopata, Cynthia......................................................................................................283
Lovis, F.B...............................................................................................................282
Lucas, Henry C. Jr.................................................................................................282
Index of authors

M

Madon, Shirin................................................................. 283
Maital Shlomo.............................................................. 282
Mansell, Robin ............................................................ 6,282
Massingue, Venâncio...................................................... 282
Mathews, E.H............................................................... 283
Mazrui, Ali A............................................................... 8, 283
McClellan, James E. III.................................................. 283
McCleure, Charles R...................................................... 283
McConnell, Paul........................................................... 283
McFarlan, F. Warren...................................................... 279
McKenney, James L...................................................... 279
Mead, M................................................................. 279
Mgombelo, H.R............................................................ 283
Mihyo, Paschal............................................................. 283
Mintzberg, Henry........................................................ 44, 283
Mouton, Johan............................................................. 283

N

Namibia Trade Directory.................................................. 283
Navathe, Shmankant B.................................................. 279
Neave, G................................................................. 283
Norton, David P.......................................................... 282
Nourouzi, Alex............................................................ 284

O

Ó Siochrú, Seán............................................................ 283
Odedra, Mayuri........................................................... 283
Oettinger, A............................................................... 3, 283
Ogdu, Osita............................................................... 283
Ogunniyi, Mesach B..................................................... 283

P

Price Waterhouse Coopers.............................................. 283

R

Raymond, Susan U....................................................... 284
Reddy, J. Mahender..................................................... 284
República de Moçambique, Comissão para a Política de Informática........ 13, 284
República de Moçambique, Ministry of Planning and Finance.................. 284
República de Moçambique, Comissão Interministerial da Reforma do Sector Público... 284
Ricart, J. E............................................................... 279
Rogerson, David........................................................ 284
Rumbaugh, James........................................................ 280
Ryer, Jeanne C........................................................... 282

S

SADC........................................................................ 10,11,284
SATCC........................................................................ 284, 285
Shain, Michael............................................................ 280
Shiu-chung, Au............................................................. 281
Sibthorpe, Claire.......................................................... 7, 287
Silva, Alberto.............................................................. 285
Solingen, Rini van....................................................... 285

309
Index of authors

Stein, Stuart ................................................. 285
Subcommittee on Computing, Information and Communications R & D ........... 285

T
Tagg, E.D. .................................................. 282
Tapscott, Don .............................................. 285
Taylor, P.B. .................................................. 283
Telecommunications Regulators' Association of Southern Africa .............. 285
TU Delft ..................................................... 285

U
United Nations Conference on Trade and Development ......................... 285
United Nations Development Programme (Programa da Nações Unidas para o Desenvolvimento) ........................................... 13, 283, 285
United Nations Economic Commission for Africa ................................ 285
United Nations Educational Scientific and Cultural Organization ............. 3, 285
Universidade Eduardo Mondlane ........................................................... 285, 286
University of Botswana .................................................. 53, 59, 286
University of Dar Es Salaam .................................................. 285, 286
University of Namibia .................................................. 150, 286
University of Swaziland .................................................. 286
University of Zambia .................................................. 286
Upadhyay, Aparna .................................................. 281

V
Valor, J. ................................................................ 279
Videira, Carlos ............................................... 285
Vincent, Tom .................................................. 280
Vlissides, John .................................................. 281

W
Wangler, Benkt. .................................................. 280
Wellmer, Gottfried .............................................. 286
Werner, M.C.M. .................................................. 283
When, Uta ...................................................... 6, 282
Whyte, Anne .................................................... 286
Wild, Kate ....................................................... 7, 287
Wilcock, Leslie P ............................................... 221, 287
World Bank, The .............................................. 4, 6, 13, 150, 287
World Economic Forum .................................................................. 67, 94, 122, 150, 175, 202, 279, 281

Y
Yin, Robert K ................................................... 19, 31, 287
Xavier, Guilherme .............................................. 281
Yourdon, E ...................................................... 243, 280

Z
Zwass, Vladimir .................................................. 232, 287
### SUBJECT INDEX

| A | Academic Registry Information System ARIS | 42, 84, 85, 98 |
| A | Acceptance and Implementation (AI) State | 39, 40 |
| A | acquisition process | 14, 15, 34, 159, 214, 216, 222, 223, 230, 232, 249, 270, 276 |
| A | African Development Forum | 8 |
| A | African Information Society Initiative | 7, 8 |
| A | African Virtual University | 144, 153 |
| A | Application Management (AM) | 27, 41, 42, 48, 49, 64, 66, 72-73, 84, 92, 94, 101-102, 120, 122, 129-30, 147, 149, 150, 156-157, 173, 175, 181-182, 199, 201, 207-208, 218, 240 |
| A | Association of African Universities (AAU) | 7 |
| B | Big ICT Five Model | 213-242, 243, 265, 272, 290 |
| B | Botswana | 1, 2, 6, 9, 10, 12, 13, 14, 16, 51-76, 162, 245 |
| B | Botswana Telecommunications Authority | 68 |
| B | Botswana Telecommunications Corporation | 13, 60 |
| B | Botswana, University of (UoB) | 14, 19, 23, 51-76, 245, 268, 273, 289, 292-293 |
| C | Capability Maturity Model | 215, 225, 252 |
| C | Carnegie Foundation | 7, 96 |
| C | Centro de Informática, University Eduardo Mondlane (CIUEM) | 107, 110-114, 116, 117, 119-122, 126-133, 244, 245, 298, 295 |
| C | charging | 41, 42, 43, 71, 72, 74, 100, 101, 103, 128, 130, 131, 155, 156, 158, 180, 181, 183, 206, 207, 209, 216, 218, 228, 230, 239, 241-242, 252, 276 |
| C | class diagram | 243, 246, 247, 248, 249, 250, 251, 252, 253 |
| C | client server concept | 244 |
| C | Communications Authority of Zambia (CAZ) | 13 |
| C | Commonwealth Secretariat | 7 |
| C | conceptual model | 20, 21, 31, 213-242, 243, 244, 259, 267, 268, 269, 271, 290, 291, 292, 293, 294, 295, 296, 297 |
| C | cost awareness | 217, 224, 239, 251, 276 |
| D | Dar-Es-Salaam, University of (UDSM) | 14, 19, 23, 77-105, 245, 268, 273, 289, 294 |
| D | development process (ICT) | 216, 222, 230, 231-232, 249, 270, 276 |
| D | development versus acquisition | 17, 104, 216, 229, 249, 276 |
| D | distance education | 38, 48, 54, 70, 85, 86, 93, 94, 97, 104, 110, 113, 114, 116, 127, 149, 151, 153, 163, 164, 165, 166, 189, 190, 193, 205, 208, 211 |
| D | donors | 1, 2, 5, 6, 8, 14, 15, 19, 25, 26, 28, 33, 35, 37, 48, 67, 69, 75, 84, 94, 96, 98, 104, 114, 123, 124, 125, 127, 132, 150, 151, 153, 176, 177, 178, 202, 203, 215, 249 |
Subject Index

ICT in six SADC countries.................................2, 12-14, 19
infiltration and impact of ICT in Africa..............1, 2, 5-9, 19
"Information Era".........................................3, 6
International Development and Research Centre (IDRC)..........................6, 7, 124
International Telecommunications Union (ITU)........216, 229, 231, 276

K
Kellogg Foundation........................................7, 124

L
Library Information System.............................70, 99, 126, 153, 178, 205
local area network (LAN)..............................26, 38, 48, 68, 70, 87, 88, 89, 91, 97, 117, 125, 126, 144, 152, 171, 172, 177, 178, 196, 203, 204, 229, 239

M
M1 State.............................................40, 68, 69, 70, 97, 98, 126, 127, 152, 153, 178, 179, 204, 205
M2 State.............................................40, 68, 69, 70, 97, 98, 126, 127, 152, 153, 178, 179, 204, 205
Management, Control and Maintenance (MCM)........26, 27, 34, 35, 37, 38, 39, 44, 47, 62, 63, 65, 66, 90, 92, 93, 94, 114, 119, 121, 122, 131, 146, 147, 155, 156, 157, 173, 180, 181, 182, 197, 199, 206, 207, 208
MCM Paradigm........................................20, 26, 28, 33, 34, 37, 45, 46, 47, 52, 59, 62, 64, 65, 67, 78, 87, 90, 92, 93, 94, 108, 116, 119, 120, 121, 122, 136, 143, 146, 147, 149, 150, 173, 174, 175, 188, 195, 197, 199, 200, 202, 274, 276
Mozambique...........................................1, 2, 6, 9, 10, 12, 13, 14, 16, 19, 36, 107-133, 245, 273, 289, 295, 296

N
Namibia..................................................1, 2, 6, 9, 12, 13, 14, 16, 135-160, 245
Namibia Communications Commission.................13
Namibia, University of (UNAM).........................14, 19, 23, 135-160, 245, 268, 273, 289, 296
NORAD..................................................96
Nuffic...................................................96, 124

O
object oriented analysis..................................243
Organisation for Economic Cooperation and Development (OECD)..............3, 4

P
Personnel and Payroll Information Systems..............69, 97, 126, 153, 179, 204
PHP...................................................245, 276

R
real system (RS)..................................28, 33, 34, 35, 37, 38, 39, 41, 45, 52, 78, 108, 114, 136, 141, 162, 188, 274
relation ICT/MCM..................................35, 47, 48, 66, 93, 94, 122, 149, 175, 201, 274
relation RS/ICT....................................34, 47, 65, 94, 121, 149, 174, 200, 274
relation RS/MCM....................................35, 48, 66, 93, 122, 149, 175, 201, 274
requirements and preconditions...............26, 34, 35, 46, 48, 65, 66, 93, 94, 122, 132, 149, 159, 174, 175, 187, 201, 214, 216, 224, 230-231, 249, 276

S
security..........................................3, 43, 45, 54, 56, 57, 58, 74, 81, 89, 103, 110, 111, 131, 139, 142, 158, 165, 166, 183, 190, 191, 209, 216, 217, 224, 228, 230, 231, 233, 236, 238, 245, 248, 275, 277
security awareness........................................217, 224, 236, 251, 276
selection process..................................126, 215, 217, 232-233, 249, 276
service delivery....................................76, 160
service delivery subjects...........................218, 240-241, 276
service level agreements (SLAs)...............27, 28, 47, 64, 66, 75, 76, 91, 92, 93, 94, 104, 121, 122, 133, 148, 149, 150, 160, 215, 217, 224, 225, 231, 233-235, 241, 250, 251, 276
service support....................................172
service support subjects............................218, 240, 241, 252, 276
South Africa......................................6, 7, 9, 10, 11, 12, 67, 68, 124, 136, 143, 150, 151, 169, 171, 176, 177, 184, 273
Southern African Development Community (SADC)..................9-14, 19, 273
Southern African Transport and Communications Commission...............10
state model.......................................20, 33, 39, 40, 48, 68, 69, 70, 97, 98, 125, 132, 152, 159, 177, 184, 203, 274
step-by-step approach................................1, 2, 19, 26, 213, 243, 267
structured query language..........................245, 276
Student Records Information System.................69, 126, 152, 178, 204, 205
Swaziland.........................................1, 2, 9, 12, 13, 14, 16, 52, 161-183, 245
Swaziland Post & Telecommunications Corporation (SPTC).................13
Swaziland, University of (UNISWA)...............14, 19, 23, 161-185, 245, 268, 273, 289, 297
Swedish Agency for Research Cooperation (SAREC)..................7, 96, 124
Swedish International Development Agency (SIDA)..................6, 7, 96, 124
system realization...............................20, 21, 243-265

T
Tanzania...........................................1, 2, 6, 9, 12, 13, 14, 16, 19, 23, 77-105, 245, 273, 289, 294
Tanzania Communications Commission................13
Tanzania Telecommunications Co Ltd................13, 96
technical assistance..................................35, 36
Technical Management (TM)........................27, 41, 42, 44, 49, 64, 66, 73-74, 92, 94, 102-103, 120, 122, 130-132, 147, 149, 150, 157-158, 173, 175, 182-183, 199, 201, 208-209, 218, 240, 274
Telecommunicações de Moçambique (TDM)..................13, 119, 124, 125
testing.............................................42, 63, 120, 217, 232, 236, 250, 276
Three Kinds of MCM.................................41, 43, 47, 48, 49, 64, 66, 74, 75, 92, 103, 104, 120, 132, 147, 158, 173, 183, 199, 209, 218, 239-240, 276
Three Kinds of MCM Model (Triple Model of MCM)..............20, 33, 40, 45, 47, 48, 64, 70, 92, 99, 120, 128, 147, 154, 173, 179, 199, 209, 274
TUDelft.............................................15, 23, 289, 291
Subject Index

U
United Nations ......................................................4, 6, 7
United Nations Development Programme (UNDP) ..................6, 7, 13, 150
United Nations Economic Commission for Africa (UNECA) ..........8
United Nations Educational, Scientific and Cultural Organization (UNESCO) ..........3, 4,
.................................................................6, 7, 86, 96, 124, 150
United Nations Population Fund (UNFPA) ..........................7
United States Agency for International Development (USAID) .........7
University Eduardo Mondlane (UEM) ................................14, 19, 23, 36, 107-133, 244, 245,
.................................................................268, 273, 289, 295
University of Botswana (UoB) ..................14, 19, 23, 51-76, 245, 268, 273, 289, 292-293
University of Dar-Es-Salaam (UDSM) ...............................14, 19, 23, 77-105, 245, 268, 273, 289, 294
University of Namibia (UNAM) ..................14, 19, 23, 135-160, 245, 268, 273, 289, 296
University of Swaziland (UNISWA) ................................14, 19, 23, 161-185, 245, 268, 273, 289, 297
University of Zambia (UNZA) ......................................14, 19, 23, 187-211, 245, 268, 273, 289, 298
Unix to Unix copy program (UUCP) .................................171
user relationships ..................................................218, 241, 252, 276
user skills ..................................................................217, 237, 251, 276
utilization state .........................................................39, 40, 68, 69, 70, 97, 98, 126, 127, 152, 153, 154, 178,
.................................................................179, 204, 205

V
validation ...................................................................20, 21, 24, 25, 217, 223, 236, 267-272, 290, 291
VSAT (very small aperture terminal) ..................................11, 68, 117

W
wide area network (WAN) ..............................................26, 60, 91, 171, 196, 229
World Bank, The .......................................................6, 7, 12, 13, 96, 124, 150
World Health Organization .............................................7

Z
Zambia .................................................................1, 2, 6, 9, 10, 12, 13, 14, 16, 187-211, 245
Zambia, University of (UNZA) .......................................14, 19, 23, 187-211, 245, 268, 273, 289, 298
Zimbabwe ...............................................................6, 9