Stellingen

behorende bij het proefschrift

The Viability of Multimedia Retrieval Systems for Marketing and Sales

Martijn Jurjen Hoogeveen
20 december 1994
Multimedia Retrieval Systemen voor Marketing en Sales zijn in toenemende mate levensvatbaar, wat blijkt uit positieve verwachtingen van experts, de aanhoudende groei van de markt op dit terrein, het toenemend aantal operationele systemen en de mogelijkheden om significante bedrijfsmatige voordelen te behalen uit het toepassen van deze systemen.

De eerste ervaringen met het toepassen van multime diatechnologie leren dat het wijdverbreide geloof dat multimedia \textit{vrijwel altijd} effectief is voor informatie- en kennisoverdracht niet op feiten gebaseerd is. Nu de multimedia-industrie volwassener wordt lijkt de tijd daarom rijp voor een nuchterder en selectievere aanpak bij het uitvoeren van multimediapроjekten.

Door het inzetten van multimediale telediensten zal op den duur een aanmerkelijk deel van de huidige verkoopstaken binnen bedrijven komen te vervallen.

Het succes van een Virtuele Markt, een digitale ruimte waarin vraag en aanbod elkaar ontmoeten net als op de markten zoals we die nu kennen, hangt in sterke mate af van de aanleg van brede, geasselaideerde informatiesnelwegen met duidelijke bewegwijzeren en bescherming tegen struikrovers.

Multimedia heeft vooral toegevoegde waarde wanneer de kwaliteit van de presentatie van informatie cruciaal is; dit is in de regel het geval aan de voor kant van een systeem, bijvoorbeeld de user interface van een informatiesysteem, de verkoopafdeling van een organisatie, of de animatie als onderdeel van een simulatie.
VI

Wanneer het versnellen van dienstinnovatie door PTT Telecom als noodzakelijk gezien wordt om te kunnen overleven op een steeds turbulentere telecommunicatiemarkt, is het verstandig om de afstand tussen Research & Development en Marketing & Sales drastisch te verkleinen.

VII

Datatransport wordt op den duur zo goedkoop als water uit de kraan ten gevolge van de liberalisering van de telecommunicatiemarkt en technologische vernieuwing. Om de grote dorst van multimediale telediensten te lessen is goedkoop, vloeiend datatransport een noodzakelijke voorwaarde.

VIII

Ook de recente dood van de wetenschapsfilosoof Karl Popper kan de inductie, dat grote denkers in metafysische zin eeuwig voortleven, niet falsificeren.

IX

Informatieverslaving is één van de grote psychosociale problemen aan het worden van onze informatiemaatschappij. Maar dit probleem loopt pas echt uit de hand wanneer een informatie-infarct, ten gevolge van een informatie-overdosis, met psychofarmaca wordt bestreden.

X

Vóór 2015 zal het eerste digitale auto-ongeluk met dodelijke afloop op de informatiesnelweg hebben plaatsgevonden.
The Viability of Multimedia Retrieval Systems for Marketing and Sales
Trefw.: multimedia / marketingsystemen.
The Viability of Multimedia Retrieval Systems for Marketing and Sales

PROEFSCHRIFT

ter verkrijging van de graad van doctor
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Prof. mr. dr. P.H.M. Vervest
To Judith, Els, Marjan, Gideon and 'X', multimedia adventurers
The results of quantitative surveys, expert assessments and Cost Benefit Analyses suggest that most MRSs are viable today; they are perceived as effective; and for the case of a Multimedia Communications Archive and tele-ordering Multimedia Business Catalogue, it has been shown that a very high Return On Investment is possible. Only the Virtual Market can not today be seen as economically effective and viable; experts believe it will take about 5-10 years before this will be the case. This implies that multimedia service providers and M&S firms that want to survive the shift from service competition to information competition in the next century, have to prepare themselves for the Virtual Market now, to be ready for an awakening market in about 5 years and a profitable market in about 10 years from now.
Summary

This Ph.D. thesis addresses the issue of the viability of Multimedia Retrieval Systems (MRSs) for Marketing & Sales (M&S), i.e. multimedia systems with a clear retrieval component, that support one, or more, M&S processes. Multimedia means that multiple information types, such as speech, music, text, graphic, still, animation and video, are used in an integrated manner. Today, M&S is one of the most viable application domains for multimedia technology. Viability, being able to survive under business conditions, is a very important issue for every investor in multimedia systems, therefore this study focuses on increasing insight into viability, and factors influencing viability, to improve MRSs for M&S and the way they are developed. An overview of potentially viable MRSs for M&S is given on the basis of extensive case research. Subsequently, business aspects, functional aspects and implementation aspects of MRSs are discussed such as the Multimedia Communications Archive for storage and retrieval of corporate advertisement material, Tele Sales Assistant for support of telephonic sales personnel, Multimedia Business Catalogue offering the possibility of tele-ordering to business customers, Multimedia Promotion System at a trade fair stand, Multimedia Aided Instruction for training marketing and sales staff, and the Virtual Market. The Virtual Market is the most appealing system, as it offers flexible support for all types of information services and meets the demands of heterogeneous groups of private and business customers.

Insight into the viability of MRSs for M&S is given by describing experimental findings with regard to the value added of multimedia, and by presenting the results of a qualitative survey of business objectives and success/risk factors for projects investigated. Experimental findings indicate that multimedia adds entertainment value as respondents experience it as fun, as enjoyable and attractive. Perceptions about the effectiveness of multimedia and multimedia retrieval are, however, more positive than can be concluded from experimental findings. The belief in multimedia has clearly taken the form of a paradigm, which needs to be corrected. Experimental findings suggest that multimedia systems are only effective for information and knowledge transfer if a high level of multimedia is combined with a high level of man-machine interactivity, adequate use of mental reference models, good quality of information representation and if audio, video, text and graphics, etc. are used congruently.

Some of the success/risk factors, identified as critical for the viability of MRSs for M&S, are seen as multimedia specific; for example, the technological complexity of multimedia projects, the scarcity of necessary multimedia expertise, too little standardisation of multimedia products, and the innovative image of multimedia systems.
Acknowledgements

These four years of multimedia business research, can be seen as an adventure through the Gobi desert. You've to cross many, many - potentially very fertile, but due to the complete absence of water - deadly bare plains. It is your quest to find the multimedia river and return some of its water to fertilise these plains. You're finding your way with a self-made compass as the sun and stars are often obscured by sandstorms, and you've to calibrate your compass regularly. Your will to proceed is tested to the uttermost, and particularly, if you hit upon a seductive business oasis it is hard to gird up your research backpack again next morning, and to start once more your search for the multimedia river.

The moment you think you've found this river, beware. It often turns out to be a fata morgana, whose bewildering promises are never fulfilled, that leads complete caravans astray. These caravans have to have clear objectives to survive, but you'll be surprised how many of these 'projects' don't and therefore are only by chance able to reach a worthwhile destination!

And if you accidentally hit upon the quick streaming, ever glittering, multimedia river, with its sparkling rainbows, impressively roaring falls, and blossoming flowers at the river sides, then you know that you haven't undertaken the journey for nothing. Still, you must dig many ditches, build many aqueducts, and cope with many risk factors, before the magic multimedia water may flow to release the plains from dryness, to fulfil your quest.

If you've finished such an adventure, believe me, you're happy to look back and thank all those who have helped you on your way. Thus, I want to express my sincere gratitude to my supervisors Henk Sol and Kees van der Meer, who patiently urged me to proceed even when I hit upon a refreshing oasis. Further, I want to thank my colleagues of the OCTOPUS project at Cap Gemini for inspiring me when I started my research and, later on, my colleagues at PTT Research where it was adopted and my colleagues at EURESCOM for innovative collaboration in Pan European multimedia services. In particular, I want to thank my PTT Research colleagues André Terpstra, Harry van Binsbergen, Ernst van Aagten, Willem Remmers and George Huijema who helped me to embed my research within PTT Research and helped to guard the usefulness of my research from the Royal PTT Nederland perspective.

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English. Finally, I want to give a thought to Beulah MacNab who 'lured' me seven years ago into the realm of Perception Psychology, and it still baffles me how essential this is when trying to explain the value added of multimedia.
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Chapter 1

Introduction

1.1. Multimedia Retrieval for Marketing and Sales

Today, the multimedia market is growing fast (Jeffcoate et al., 1993) and attracts global players from consumer electronics, information technology and telecommunication industries, like Apple, Microsoft, IBM, Philips, AT&T, Nintendo, and many others. These companies are putting considerable effort into conquering an anticipated market offering appealing, beautifully interfaced systems for business applications and home entertainment. Now, multimedia is booming, despite of all the warnings of the pessimists. Multimedia has its roots in the home computing world in the eighties. Multimedia home computers were the first to be equipped with video and audio extensions to further improve their entertainment value. Their business value was limited to niche markets such as video editing. It was not until the offset of the nineties that the marketing potential of multimedia was widely recognised and multimedia was introduced into the world of the PC to revitalise the PC market. Since then developments have accelerated. Today, multimedia computing has become one of the major information technology trends. More and more information systems are being developed that are not only able to handle text, but also different information types\(^1\) like audio, stills, graphics and video. Multimedia systems are being developed for an astonishing, and still growing, number of application fields. One of the most promising application fields for multimedia, according to market research, is marketing and sales (Jeffcoate et al., 1993; Harlaar & Van Pelt, 1993). In the sphere of marketing and sales, multimedia systems are often used as gadgets to improve business presentations by sales people (Hooper Woolsey, 1991), as attractive points of information in galleries and points of sales in commercial environments (Josephson, 1991; Arbuthnot & Khalil, 1993), as sophisticated multimedia catalogues on CD-ROM or CD-i, or as sales support systems for sales employees. The value added of multimedia systems for marketing and sales is attributed, among others, to the communicatory power of moving pictures and

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\(^1\)In an attempt to get around the definition problems the free use of the ambiguous word ‘media’ creates, I prefer to use the term ‘information type’.
audio, to an improvement in information and knowledge transfer using data visualisation techniques, and to the motivating effects of interactive gaming elements. To go further, it is claimed that multimedia systems help to raise sales figures and to improve the response rate to marketing actions, however, evidence for such claims is not given. The explanation for this lack of evidence is that it is probably not in the short term interest of information technology suppliers to evaluate their multimedia systems and, that evaluation requires considerable effort from the marketing and sales organisation involved.

Multimedia is also welcomed by educational researchers, who assume that congruent use of multiple information types increases learning effectiveness (Heller, 1990). Multimedia assisted instruction is used in the marketing and sales sphere to inform sales people about new product developments and to train business customers in the use of certain products or services.

Currently, an important development setting new frontiers in the world of multimedia is the evolution of multimedia systems from stand-alone systems to networked systems, which brings us in the worlds of (tele)communication and broadcasting. An extrapolation of this development is the electronic data highway (Reinhardt, 1994). This highway, it is envisioned, will give companies and citizens free access to multimedia services. Both governments and the business world have high expectations of the electronic data highway since it may offer the infrastructure for a virtual market (Hoogeveen & Van den Eijnden, 1994), which may stimulate the introduction of innumerable commercial activities, and may become the economic centre of gravity for the next century. In the sphere of marketing and sales one can see for example, the development of multimedia tele-malls which offer a subscriber the possibility of entering a virtual shop, to select products from the virtual shelves and to purchase them. Another example is the use of interactive tele-advertisement, already possible with interactive TV systems. Despite these high expectations, it must be realised that it will take many years before an electronic data highway is realised. It requires large investment in communication infrastructures to provide on and off ramps to the electronic data highway and the enthusiasm of investors is tempered by uncertainty about the viability of commercial multimedia services. Furthermore, one of the key technologies, namely Multimedia Retrieval (MR), is still under development.

MR is a key technology in a technical sense as it is at the heart of almost every multimedia system or multimedia service. Besides, it is also a key technology in a strategic and economical sense. Information and the ways information storage and access are organised are of tremendous strategic and economical value in a society which is becoming more and more an information society, in which software sales have a higher value than hardware sales, and in which copyright protected information has a relatively stable value in a world of decreasing hardware costs. This makes clear why sound MR systems (MRSs) for accessing and managing multimedia information sources are so vital.

It is not yet crystal clear what MRSs will be used to offer (on-line) access to and management of valuable multimedia information bases.

With the maturing of multimedia systems and development of multimedia services the limitations of more conventional retrieval technologies for managing and accessing databases have become evident. Therefore, Data Base Management Systems (DBMSs)
(Date, 1986) which are commonly used for the retrieval of small alphanumeric records from large databases, and which form the core of most information systems, have recently been extended by the addition of facilities to handle multimedia database objects. In addition the need is felt, in some cases, to be able to include the document retrieval facilities offered by Information storage and Retrieval Systems (Salton, 1989), commonly used in archives and libraries. MR adds to all this new ways to retrieve data, for example by providing browsing mechanisms for video, by using pictorial search mechanisms or by using natural-language interfaces.

Yet, these extensions to DBMSs are sometimes not enough. In the situation where on-line multimedia services are offered to a large number of subscribers, performance becomes such a major bottleneck that usage of conventional DBMSs leads to unacceptable performance losses. Specially designed media servers with high processing power, a high input/output throughput and sophisticated compression functionality provide a possible solution for this case.

1.2. Insight into the viability

In the previous section I pointed out that marketing and sales (M&S) is one of the most promising application areas of multimedia. Next, I stated that MR is an important, fast developing, key technology at the heart of almost every multimedia system or multimedia service. A third point is made for the viability aspects of multimedia systems or services. These three points limit the scope of this thesis to the viability of Multimedia Retrieval Systems for Marketing and Sales (M&S). An MRS for M&S is a multimedia system with a clear retrieval component, that supports one, or more, M&S processes. In this context, M&S is defined as those business processes in an organisation directly related to the marketing and selling of goods and services, including support processes such as training sales staff and performing marketing research.

The fast developments within this research domain, particularly the advancements of MR technology, make it interesting to understand early experiences with developing MRSs for M&S. This will assist us to improve these systems and to improve the development of these systems. This bring us to the main research issue, viability, how viable are MRSs for M&S? The viability of MRSs for M&S are a major issue for every investor in multimedia systems for M&S, and insight into viability should guide the improvement and development of MRSs for M&S. Viability here refers to the state of being able to survive under business conditions. This implies that MRSs for M&S are technically feasible, are accepted by the market, by the users and by the principals. An example of a system that proved to be viable is the PC: they are technically feasible, and are accepted by the market. Examples of systems that did not prove to be viable are easy to find: aircraft that never left the ground, information systems that were build but never used, etc. Presumably, viability also has a

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2Further on the word multimedia systems is used to include multimedia services, except when indicated otherwise.
time aspect: the higher the viability of an MRS, the longer the multimedia system will be able to survive under business conditions, and, once viable does not mean always viable, systems have a life cycle. The viability of MRSs for M&S appears to depend on the effectiveness or perceived effectiveness of an MRS in terms of meeting M&S business objectives. This may boil down to raising sales volumes, better promotion of product X, more effective training of sales people, or an improved corporate image. In general terms, these business objectives are related to improving the effectiveness, efficiency, and productivity of business processes, or are significantly meaningful in terms other than economical.

Given the above, the main research question of this thesis is formulated as follows:

**What is the viability of Multimedia Retrieval Systems for Marketing and Sales?**

Answering this question should lead to more insight into this viability, and the factors influencing the viability of MRSs for M&S. The effects of extending a system with MR facilities and the effect of this on system effectiveness in terms of meeting business objectives and subsequently viability need to be well understood. This insight may lead to useful guiding principles for the improvement and development of MRSs for M&S, in particular insight into realistic business objectives and business opportunities may prove worthwhile. Insight into the value added of MR in relation to system effectiveness is useful when considering the use of the more advanced fruits of retrieval technology, like full text retrieval and search profiles. This is important, as in current multimedia systems for M&S, these advanced retrieval facilities are often ignored by system developers. Insight into success/risk factors which strengthen or threaten the viability of multimedia systems, may also prove useful when developing MRSs, by helping to avoid costly mistakes.

1.3. Research approach

In this section the research approach is discussed, and is illustrated by the precedence chart given in figure 1. The main thread of the research process is shown as a bold line and starts with the research question followed by the development of a framework, the characterisation of current and innovative MRSs for M&S using the framework, the formulation of hypotheses and the testing of these hypotheses.

In general, several data sources are used to develop the framework, to describe and advance MRSs for M&S, to formulate hypotheses and to test hypotheses. As can be seen in figure 1, literature surveys, case research, and expert surveys are used. As a part of expert surveys, experts are confronted with demonstrators, scenario’s and questionnaires to measure their responses.
With regard to case selection it is important to note that most of the cases selected are taken from work carried out at the Koninklijke PTT Nederland NV (KPN) and its subsidiary PTT Telecom BV. KPN is the principal for this research. There are two reasons for KPN's interest in the research subject discussed. First, M&S are major business processes within it's subsidiaries, for example, business sales and consumer sales within PTT Telecom. Second, KPN is a service provider, interested in offering MR services to its private and business customers. An example of a predecessor to such MR services is Videotex. Most of the Videotex applications available today have an M&S purpose, for example a wine shop selling wines via Videotex or the marketing of motorist services by a motorist association.

The fact that most of the cases are selected from one company, raises the problem of the generalisability of the findings, and this is somewhat reinforced by the fact that almost all of the cases are situated within The Netherlands. Thus, a cultural bias may also be introduced into the findings. I assume that the generalisability problem is softened by making use of international literature surveys, surveys explicitly including non-KPN firms, and the inclusion of some non-KPN cases. I also assume that the M&S activities of PTT Telecom, a

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3Royal PTT Nederland NV
large, international and heterogeneous company, are representative of the M&S activities of other firms in at least the western world. In other words, I assume that PTT Telecom's experiences with MRSs for M&S will not differ fundamentally from the experiences of other large companies in other (western) countries. An argument in support of this assumption is that PTT Telecom is part of a privatised company which uses the same resources as other international companies do; that is increasingly competing against other international companies in the same market places; and is becoming more and more involved in international partnerships. PTT Telecom uses the same MR technologies as other businesses in the world do, and similar ideas about organising business are accepted. An argument that weakens the generalisability assumption is that every company is unique in many respects, for example in its innovativeness, its financial resources, the size of its M&S activities, and the size of its bureaucracy which is an inhibiting factor.

What we can conclude from this is that we must be careful about generalising research results about viability aspects.

The four main research activities are discussed below, using four subquestions, derived from the main research question given in the previous section.

Development of a framework

A fixed framework is necessary to be able to characterise MRSs for M&S systematically. Such a framework consists of relevant characteristics of the research domain. Thus, to develop such a framework it is necessary to analyse what the essential characteristics of the research domain are. Hence, the first subquestion is:

1. What are the essential characteristics of MRSs for M&S?

In other words, how can MRSs for M&S be best characterised or what are the basic elements which characterise the business, technical and informational aspects of MRS for M&S? Several data sources were used to develop the framework.

• The literature was reviewed to obtain stable and representative characteristics to describe M&S, multimedia system and retrieval engine characteristics. The literature was surveyed with regard to current developments in M&S, multimedia systems (Hoogeveen, 1993a), retrieval systems (Hoogeveen & van den Bempt, 1993) and standardisation of Multimedia DBMSs (Kwaaitaal, Hoogeveen & Van der Weide, 1994).

• Commercial Multimedia DBMSs were reviewed to get insight into the state-of-the-art technological developments with regard to the access and management of multimedia databases (De Ruyter, 1993). This shed light on the feasibility of the MR component of multimedia systems.

• In-depth case research was performed to identify practical characteristics of marketing and sales, and retrieval engines. This was a welcome addition to literature research. Case research is useful because it helps to determine the practical importance of certain theoretical aspects. PTT Telecom served as a case for the M&S characteristics. Participant observation in the OCTOPUS case proved to be useful in particular with regard to retrieval engine characteristics (Hoogeveen, Van der Meer & Sol, 1992b).
The OCTOPUS experience gave an idea of which retrieval facilities are the most common, which facilities are used regularly by expert users, and which are only used in very special situations. Participant observation of several multimedia projects within PTT Research proved useful to obtain insight into multimedia system characteristics.

**Characterisation of current and innovative MRSs for M&S**

Before formulating ideas about the viability of MRSs for M&S, it is first necessary to characterise these systems; there is little value in reviewing nonviable system artefacts. Thus, the second subquestion is:

2. *What potentially viable MRSs for M&S can we distinguish on the basis of practical examples or as extrapolations of developments in M&S, multimedia systems and retrieval engines?*

The framework was used to systematise the characterisations of the systems, addressing both the technical and the business characteristics. The systematisation of system characterisations is necessary to reach an acceptable level of completeness, to make it more easy to compare systems with each other, and to help in identifying ways to improve or extend the systems. The value of the MRSs for M&S presented is that they can be (re)used as basic models for MRSs for M&S.

In subquestion 2, two ways to characterise the systems are mentioned, namely on the basis of practical examples and as extrapolations of developments in the research domain.

- The practical examples or cases were almost all, selected from within KPN. The use of practical examples guarantees that the systems based on them are at least feasible. The practical examples give an idea about related business objectives and opportunities, and success/risk factors. A limitation of practical examples is that they are often not the most innovative.

- Extrapolations of developments are reviewed on the basis of a survey of multimedia projects and are reflected in the framework for MRSs for M&S. The feasibility of MRSs for M&S based on extrapolations are demonstrated by experimental prototypes, several of which were developed within the context of my Ph.D. research project within PTT Research.

**Formulation of hypotheses**

Now, we get onto one of the key issues: the formulation of hypotheses about the viability, and the variables influencing the viability, of MRSs for M&S on the basis of early experiences with some of these systems. Subquestion 3 can be formulated as follows:

3. *What hypotheses can be formulated about the viability of MRSs for M&S?*

The hypotheses should make manifest the ideas, convictions, and experiences that MR developers share with regard to the (variables influencing the) viability of MRSs for M&S. Such a set of related hypotheses forms a theory. The term 'theory' is used here in the sense of *grounded theory* (Glaser & Strauss, 1967), i.e., a related set of ideas or hypotheses induced by empirical research data. The term 'grounded' stresses the point that the theory is
closely related to a limited empirical research domain, in this case the viability of MRSs for M&S.

The formulation of hypotheses on the basis of early experiences with developing MRSs for M&S has three advantages. As said before, it makes clear what are the essential experiences with, and basic convictions about, MRSs for M&S. This may help us to understand somewhat better why and when MR systems are (believed to be) effective for M&S. For this reason it is important to explain the value added of MR. The second advantage of hypotheses formulation is that these hypotheses about the viability, and variables influencing the viability, of MRSs of M&S become testable. A third advantage is that the set of hypotheses, insofar confirmed, can be used cautiously, as guiding-principles when developing MRSs for M&S. Therefore, the hypotheses should make explicit typical business opportunities and typical success/risk factors for MRSs for M&S.

Hypotheses were formulated on the basis of:

- data from case research, namely early experiences with developing MRSs for M&S purposes;
- hypotheses and descriptions of experiments described in the literature;
- data from a survey of business opportunities and objectives, and success/risk factors for multimedia projects and multimedia systems.

Testing hypotheses

Hypotheses about the viability, and variables influencing the viability, of MRS for M&S must be operationalised and tested to draw conclusions about their validity. Subquestion 4 was, therefore, formulated as follows:

4. What support can be found for hypotheses about the viability of MRSs for M&S?

As true experimental conditions (Kidder, 1981) are not possible when studying in vivo business phenomena it was necessary to adopt quasi-experimental methods and to look for convergent evidence, i.e., to look if evidence from different data sources pointed in the same direction. It is very important to note that the viability of MRSs is most often assessed retrospectively, but that the history of MRSs is so short that retrospective analysis is only possible for the first generation of MRSs. In several cases, the systems have to show their true worth yet. Despite these limitations there are ways to approach the viability problem, although the reliability and validity of the outcomes will not be 100%.

- Experts panels were used to validate hypotheses about developments within the experts fields of expertise, e.g., to test hypotheses about the respondent's perceptions of viability and related variables, like the value added of multimedia, and specific success/risk factors. An assumption underlying the use of an expert panel approach is that experts come to better judgements about developments within their fields of expertise than laymen. This assumption can, however, be disputed. A good example to the contrary is that most Eastern Europe experts, like everyone else, did not foresee the sudden collapse of the communist regimes. Another major point is: are the developments fundamentally unpredictable or not? I assume that developments within the research domain are predictable to some degree, and that in most cases experts
predict better than laymen or that experts can better found their judgements than laymen.

* Several MRSs for M&S were evaluated. Cost Benefit Analysis was performed and Return On Investment was estimated to make a reasonable case for the economic viability of some of the implemented MRSs. The limitations of IT (information technology) evaluation methods such as Cost Benefit Analysis and Return On Investment are discussed by Farbey et al. (1992), who give an overview and classification of available IT evaluation methods. It can be concluded from their work that no completely satisfactory method exists to evaluate both quantitative and qualitative benefits, due to uncertainties and difficulties with quantifying, in monetary terms, certain qualitative benefits like 'improved image' or to give valid forecasts of quantitative future benefits like 'expected extra revenues'. Likewise, De Loe and McLean (1992) observe in their review of dependent variables for Information Systems Success that quantitative Cost Benefit Analyses are often found lacking due to the difficulty of quantifying 'intangible benefits'. Despite these limitations, I believe that the outcome of a Cost Benefit Analysis is a valuable indication of the viability of a multimedia system.

* Market research is reviewed to look for convergent evidence with regard to viability, and to obtain a concurrent validity estimate for some expert panel estimates.

### 1.4. Outline of the thesis

The outline of this thesis follows the activity structure and order of subsections presented in the previous section. In this chapter, the research subject, the research question, and the research approach followed are introduced and explained.

In *chapter 2* the M&S business aspects, multimedia system characteristics and retrieval subsystem characteristics that are stable enough to systematically characterise MRSs for M&S are analysed. These characteristics taken together form the framework. With regard to the M&S business level, a typology is proposed, formulated in generic terms but discussed in M&S specific terms. At the system level the multimedia processing elements and information types involved are discussed. At the subsystem level the type of retrieval engine and the essential retrieval facilities are discussed. Finally, the characteristics of the framework are summarised visually.

The framework presented in chapter 2 is used in *chapter 3* to characterise potentially viable MRSs for M&S. The MRSs range from systems based on case research, such as a Marketing Communication Archive, a Tele Sales Assistant system, a Multimedia Business Catalogue for business sales assistance, a Multimedia Promotion System at a trade fair, and Multimedia Assisted Instruction for self-help training on the job, to innovative systems based on extrapolations of current technological developments, such as a Marketing Documentation Archive and the Virtual Market. To conclude chapter 3, an overall system is presented to put all the MRSs together and to show the interconnections between these systems, working together in one imaginary M&S organisation. Next, the MRS related business objectives and noticed success/risk factors for developing MRSs are summarised.
This information about business objectives and success/risk factors is used as input for the formulation of hypotheses in chapter 4. Chapter 4 presents hypotheses about the viability, and the variables influencing the viability, of MRSs for M&S. One of these variables is the value added of MR technology. This value added is delineated and explained by discussing experimental research findings described in literature. Other variables are the success/risk factors mentioned before. Hypothesised success/risk factors are listed and discussed on the basis of a survey of multimedia projects. These success/risk factors are grouped into project management success/risk factors and multimedia system success/risk factors. The business objectives and the success/risk factors are related to the MRSs presented in chapter 3 to give insight into MRS related differences. Chapter 4 ends with a discussion about the operationalisation and measurement of the viability of MRSs for M&S and a summary of testable hypotheses.

The selected hypotheses are tested in chapter 5, which has two parts. The first part contains the results of expert assessments. The second part contains two Cost Benefit Analyses and computations of Return On Investment. The first part starts with the results of a survey of multimedia projects on the value added of multimedia and the relevance of success/risk factors. Then we proceed with a general expert assessment of the viability of seven clusters of multimedia teleservices. Next, the results of two more specific evaluations by an M&S panel are given for a Multimedia Business Catalogue and a promotional system. Thereafter, the results of an interesting survey of potential investors in multimedia teleshop services are given. The second part of this chapter contains a retrospective Cost Benefit Analysis and ROI computation of the IECT photo archive, and the results of a prospective Cost Benefit Analysis and Return On Investment computation of an MRS for tele-ordering by Top 1000 accounts are presented.

Chapter 6 returns to the main research question presented in the first chapter. An answer is given on the main research question with reference to the developments noted in the research domain in chapter 2, early experiences with developing MRSs for M&S presented in chapter 3, the hypotheses formulated in chapter 4 and the test results presented in chapter 5. Next, the consequences of the findings for the further improvement of the MRSs, and the consequences for the development of these systems are discussed. The discussion about the generalisability of the research findings is important. Further, conclusions are drawn with regard to the research approach: what is the usability of the framework presented, the theory presented, and the research methods used. Chapter 6 is concluded by looking forward and formulating recommendations for further research on the viability of MRSs for M&S.
Chapter 2

A Framework for Multimedia Retrieval Systems for Marketing & Sales

2.1. Introduction

A tripartite framework for Multimedia Retrieval Systems (MRSs) for Marketing & Sales (M&S) is given in this chapter to answer the question: what are the essential characteristics of MRSs for M&S? In the introduction it is pointed out that such a framework is necessary to characterise such systems systematically.

First, the M&S business level characteristics are discussed (see section 2.2.). MRSs for M&S are part of a demanding and turbulent business environment, which can be described in terms of its vital business objectives, its products and services provided, its tasks and processes, its employees and its customers, the types of information items that are processed and the types of supportive information systems.

Second, the system level characteristics are discussed (see section 2.3.). MRSs for M&S are Multimedia Systems (MSs) that make use of multimedia (MM) technology, and can be described in terms of information types processed and types of multimedia processing elements used.

Third, the subsystem level characteristics are discussed (see section 2.4.). MRSs for M&S make use of a customised retrieval subsystem, a retrieval engine, which can be described in terms of its integrational approach to the handling of multiple information types, and the retrieval facilities that it offers.
2.2. Developments in Marketing & Sales (M&S)

2.2.1. Introduction

The western economies have transformed into service economies in the last decades, meaning that more than half of the gross national product is produced by the service sector (Grönroos, 1990). With the heralded coming of the infobahn or data highway (Reinhardt, 1994) it is expected that our economies once more will experience a transformation, this time from a service economy towards an information economy in which quality of information is the major competitive edge for companies; we then can speak of information competition. The New Brunswick Task Force on the Electronic Information Highway (1994) estimates, optimistically, that in the year 2000 15% of the gross product of the world will be generated by information industries, and the New Brunswick Task Force foresees ongoing growth. This implies on the one hand that an information economy, in which more than 50% of a gross national product is generated by information processing activities, will appear eventually, and on the other hand that it will take many decades before the world economy will be really dominated by information industries. Let us leave these speculative grounds and review the competition of today.

Today, service firms have come to realise that competition is now so severe that offering merely technical solutions to customers is not sufficient to create a competitive edge. Even industrial manufacturing firms have to offer customers a variety of services as an integral part of their total offerings (Grönroos, 1990), as customers primarily want to have complete solutions for their business problems and needs.

Since today competition between finns is increasingly focused on service, Grönroos speaks of service competition. This increase in service competition is both market driven and technology driven. It is market driven because customers have more and more sophisticated demands; customers are in the negotiation position and able to demand more of their suppliers because of the fierce service competition between suppliers in globalising markets. Customers constantly need to update their requirements to their suppliers, because they find themselves in a fierce service competition.

The increase in service competition is also technology driven, due to the advancements in Information Technology (IT) (Porter & Millar, 1985) which enables firms to improve their quality of service, for example, by being more flexible in meeting the requirements of their customers (e.g., 'just in time') or by being more informative (e.g., by offering a helpdesk).

Improving the quality of service, the degree to which customers appreciate the services provided, is one of the main business objectives of western firms today, especially M&S firms, which are becoming more and more customer oriented. This is also experienced by PTT Telecom, particularly since the privatisation of the parent company KPN and the increase in market competition that will culminate in the complete liberalisation of the European telecommunication markets in 1998.
2.2.2. Improving the quality of service and other business objectives

It is a fundamental necessity to pay attention to the business objectives a firm wants to meet by investing in an MRS. Identifying the business objectives of an MRSs for M&S refers us to what Sol (1982, 1992) calls the systological problem: why or for what should we invest in an information system?

It is important to realise that investment in MRSs for M&S should lead to improvements in terms of effectiveness, efficiency, productivity or improvements that are really meaningful in another sense. Effectiveness is related to the question "are we doing the right things". Wentink & Zanders (1988) define effectiveness as the degree to which formulated goals are actually met. We can regard improving the quality of service as one of the most important effectiveness objectives for an M&S firm. Efficiency is related to the question "are we doing things right", and can be defined as the degree to which minimal resources are applied to produce a certain output. Productivity is often defined as output/input (Wentink & Zanders, 1988).

MRSs are valuable within PTT Telecom, for example, to meet business objectives such as upgrading existing services (quality of service), improving the effectiveness of marketing actions, or training the sales force efficiently.

Improving the quality of service is a vital effectiveness objective for an M&S firm wanting to survive fierce service competition. PTT Telecom is also becoming increasingly aware of the importance of improving the quality of service, this is seen as vital for the defence of its current prosperous market position and for extending its international market positions. For these reasons it is worthwhile to discuss this major business objective of an MRS in more detail. Three quality of service aspects can be distinguished:

- the quality of the products and services provided;
- the quality of the interaction between customer and supplier;
- the quality of the information about the products and services provided.

These three aspects are discussed below.

Quality of products and services provided

The basics of quality of service are, of course, to deliver good products and services at a good price to meet the expectations of the customer. This is easily said, but hard to make work in reality. Mason (1993) notes two service quality gaps in this respect: 1) wrong service quality standards are implemented, because customer needs are not really understood or well translated into service qualities, 2) a service performance gap occurs, because retail employees cannot or will not offer service at the level of customer

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4 Doswell defines efficiency as: efficiency = (output - input)/output (Wentink & Zanders, 1988).
expectations. Therefore, it is important for marketers\(^5\) to investigate customer satisfaction, customer needs and customer complaints. Measures to improve the price/performance ratio of products and services are a) to improve the quality of the products and services, and b) to lower prices. In the PTT Telecom case, lowering of prices is reinforced by severe competition over prices, or price/performance ratios, in the international and mobile telecommunication mass markets. Such developments force PTT Telecom to cut costs by taking efficiency measures, to raise the productivity of employees, and to penetrate markets with higher margins. The introduction of services with more value added is one of the options for penetrating high margin markets.

**Quality of the interaction between customer and supplier**

The quality of the interaction between a customer and a supplier is not a neglectable factor, it refers us to *personal, socially correct and friendly interacting with customers, contributing to the appreciation of services provided*. This interaction is influenced heavily by security measures (e.g., barricaded bank counters), use of IT (e.g., man-machine interaction), efficiency measures (e.g., less sales people on the shop floor), and other measures. The drive for efficiency is often incompatible with the need for more personal and human customer care. It is believed by some that the 'computer with a human face' can reconcile those seemingly incompatible factors. Teleservices especially, can benefit from improved interface technology, removing the current interfacing hurdles (Jones, 1993).

A very important service quality gap (Mason et al., 1993) in this respect is not knowing what customers expect. The causes of this are probably a lack of sound market research, a failure to interact well with customers to get a clear idea of what their expectations are, and too many bureaucratic organisational layers which separate floor level personnel and management. Correct handling of customer complaints and suggestions can close this gap, and for this reason PTT Telecom gives a high priority to increasing customer care by the correct handling of customer complaints and suggestions.

**Quality of the information about products and services provided**

*The quality of product and service information is a matter of effective, but realistic, communication of what the benefits and characteristics of products and services are.* Mason et al. (1993) noted in this respect a service quality gap which occurs when promises do not match delivery.

For example, it is a crucial element of good customer care that customers get correct answers on their questions when purchasing telecommunication products. This is part of customer support when customers encounter problems, such as bugs and errors in the licensed electronic mail software packages they use.

MRSSs can play a role in improving the quality of service for these three aspects, namely in:

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\(^5\)A marketer is someone seeking a resource from someone else and willing to offer something of value in exchange (Kotler, 1991).
• getting more insight into customer needs and requirements, for example, by a teleshop system that presents now and then, short questionnaires to users in an attractive and easy-to-handle way;
• giving a more realistic view of products and services to customers to prevent unrealistic expectations, for example, by using a sales system that visualises and simulates products usage and the services provided;
• supporting sales conversations between sales people and customers, for example, by providing a system with which a sales person can help a customer to visualise his current and future data communication situation and the alternative ways his needs can be met;
• effective and attractive communication of product and services information to motivate people, for example, in the form of interactive advertisement with gaming elements.

2.2.3. Types of products and services

PTT Telecom offers a broad variety\(^6\) and deep assortment\(^7\) of telecommunication products and services. These products and services range from telephone connections and telephones to Videotex services and the required hardware equipment. MRSs for M&S may have several functions for PTT Telecom with regard to the provision of products and services. The first function is that they can be used to support the marketing and selling of products and services. Such sales support systems must often contain realistic representations of the products and services to support their recognition or to improve the marketing of these products and services. The recognition of products and services is, for example, important for a sales employee who helps a customer select white telephones which are in stock, but not in the shop. Another example is that MRSs with an M&S support function may be offered as a supplementary service to customers in the form of an MM manual of the switchboard just bought.

A second function is that MRSs may function to produce and distribute product and services related information. An example of this is a publishing system for the production of glossy leaflets or setting up an on-line maintenance database.

A third function is that MRSs for M&S may enter the service portfolio of PTT Telecom, for example, in the form of an MM successor to Videotex. This is a type of MM Value Added Network Service offering on-line retrieval facilities to access remote M&S databases. An existing application is the presentation of the shoe sales stock of a shoe factory to its retail customers. Such MRSs may also be used as the vehicle to distribute interactive videos to tele-ordering consumers. One can envision PTT Telecom offering access to a telemall, a teleshop environment, which provides the customer with 3D views of products, and saving the

\(^6\)Variety: the number of lines of merchandise carried.
\(^7\)Depth of the assortment: the choice of products offered within a line of merchandise carried.
customer with little spare time from physically having to go and purchase the items available.

2.2.4. Types of tasks and processes

It is important to include the types of M&S tasks and processes supported or performed by an MRS in the framework. The reason for this is that business objectives are often formulated in terms of improvements in task and process performance. From this we can derive system requirements.

M&S are, apart from business processes like network service management, important business processes for PTT Telecom. M&S processes in general are believed to benefit from MRSs, for example, in the form of MM kiosks (Josephson, 1991).

In this section we will only consider M&S processes that are either candidates for support by MRSs or that are candidates for being performed by MRSs. An example of the latter is an MM kiosk that performs the tasks of a sales assistant.

Tasks can be defined as discrete units of work at a micro level, performed by human workers or by information systems. Tasks can have a primary or secondary nature, and they can be more or less structured. Selling telecommunication services is, for example, a primary task of PTT Telecom sales employees, and includes both structured and ill-structured aspects. Customer interaction is ill-structured, but noting an order for a simple product is relatively structured, i.e., filling in a form.

The M&S tasks and processes that seem to benefit from MRSs have one or more of the following aspects in common:

- quality of communication - getting across the message - is very important;
- M&S information is presented to a customer, and therefore needs to be polished;
- promotion, using marketing media ranging from broadcasting to narrowcasting;
- MM information is used coherently to present audio-visual products and services, information types included are: video, music, speech, text, graphics, photographs, animations, etc.;
- a dialogue, including questions and answers, between customers and marketing and sales departments; this dialogue is backed up by product managers, who in their turn function as customers in their dialogue with their suppliers;
- a focus on transactions (i.e., goods or services are ordered);
- large M&S databases are used.

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8Narrowcasting is the use of focused marketing media for selected target groups. Examples of such marketing media are bill boards for fair visitors and telecommunication magazines for telecommunication minded business people.
A stylised overview of M&S processes within PTT Telecom is given in fig. 2. I have chosen such a stylised representation because PTT Telecom is in a permanent process of reorganisation, and more exact representations would be outdated within a year. The M&S processes are clustered into three groups. At the left are the processes with direct market and customer contact: marketing and sales. Within PTT Telecom marketing and sales are separated, as is the case within many M&S organisations that have passed the first stages of growth (Kotler, 1991). The sales outlets are mainly organised regionally; only international accounts are serviced from the headquarters. Marketing functions are mainly situated at the headquarters, but many of the operational tasks are delegated to the telecommunication regions. To the right are a number of heterogeneous M&S processes which are referred to by the collective term 'policy & support'. These processes are predominantly centralised.

**Marketing**

*Marketing* is defined by the American Marketing Association as the process of planning and executing the conception, pricing, promotion, and distribution of ideas, goods and services to create exchanges that satisfy individual and organisational objectives (Kotler, 1991). The main business philosophy with regard to marketing is that the key to achieving organisational goals consists of determining the needs and wants of target markets and delivering the desired satisfaction more effectively and efficiently than competitors.
Marketing is often performed by separate marketing organisations within an M&S firm. According to Burnett (1993) a marketing organisation is governed by a marketing plan, which is the central instrument for directing and co-ordinating marketing effort. Burnett sees this plan as just one part of a strategic plan, which provides direction for the entire organisation. He describes further that a marketing plan is defined in close co-operation with central staff and consists of basic decisions on total marketing expenditure, marketing mix, and marketing allocation. Marketing mix is the set of marketing tools that a firm uses to pursue its marketing objectives in the target market; McCarthy popularised a four-factor classification of these tools called the four Ps: product, price, place (i.e., distribution) and promotion (Jain, 1990; Kotler, 1991).

A promotion plan is, according to Burnett, derived from the marketing plan, and can be seen as an operationalisation of strategic marketing objectives in terms of marketing actions, i.e. promotions. Reality, however, is often unruly and does not behave in accordance with Burnett's ideas. Nevertheless, in the case of PTT Telecom we can indeed distinguish between the strategic plan, marketing plan and promotion plan as described by Burnett.

The product life cycle with regard to M&S starts with product and service management. Product and service managers within the PTT Telecom Business Units are extremely interested in how their products and services perform, since they are eager to meet their targets in terms of sales volume per product/service. Therefore they want the latest information about turnover per product/service per market segment. This information may be provided by convential sales related information systems. Product managers are also extremely interested in ways to communicate their product information effectively to sales people and to their markets. This requires a lot of fine-tuning between market departments and sales departments in the regions. In larger M&S firms, such as PTT Telecom, it is a major problem that product managers are oversupplied with product information by their suppliers, and they in their turn, oversupply their sales force with product information. As a consequence, communication is not as effective as wished.

Product managers and marketers depend for their decisions on market research (Jain, 1990; Ingram & LaForge, 1992). Market research is the research that deals with information about trends within product-market combinations, and the buying behaviour of current and potential customers: who they are, why they buy a product or service, where they buy it, when they buy it, how they buy it, etc. Often, in practice, market research is used interchangeably with the term marketing research (Jain, 1990), but, marketing research, in addition to market research, also deals with information relative to marketing mix variables: product, price, distribution (place), and promotion. Both market research and marketing research can be supported by Marketing Information Systems (see paragraph 2.2.7.). Decisions on marketing mix variables are often made by product and service managers, by marketing managers, and by outlet managers.

Within the marketing departments that have actual contact with the market, either directly or indirectly via the sales outlets, marketing actions are prepared and carried out, and continuous gathering and analysis of market information is performed. The latter is called market intelligence (Jain, 1990). Marketing actions range from huge TV campaigns to more
limited marketing actions like special offers in shops. Within PTT Telecom, nation wide marketing actions are prepared by the central Business Units. The execution of limited marketing actions is performed by the regionally organised sales outlets. The major ingredients of promotion (marketing actions) are according to Burnett (1993):

- Directory advertising, by placing advertisements in business to business registers like the Thomas Register in the USA with 60,000 pages. Commonly used directories in the Netherlands are the "bedrijven voor bedrijven" (business-to-business) directory and the "Gouden gids" (yellow pages). The main advantage of directory advertising is that it uses highly credible media, directoriesregisters, and directories are the basic purchasing tool for many buyers (Reeder et al., 1991). A drawback is that the medium has a low attention value, i.e., unless buyers purchase directories for use, advertising in this medium is not seen.

- Consumer media, like TV, radio, newspapers and magazines, which can be very effective in spite of the fact that these media have a rather 'shot gun' approach with small percentages of the publicity hitting a target.

- Direct Marketing (DM), most often related to database marketing, is increasingly applied in marketing. According to the Direct Marketing Association, DM "is an interactive system of marketing which uses one or more advertising media to effect a measurable response and/or transition at any location" (Burnett, 1993). The availability of sophisticated marketing databases with information about consumer characteristics and behaviour, is considered indispensable for DM. Contact just those and only those who are in your target audience. DM is distinct from indirect marketing in that: DM staff sells directly to the consumer/customer bypassing the retailer. DM is not awareness advertising but direct-response advertising. DM relies more on direct order marketing or direct response selling than personal selling (Burnett, 1993). Vehicles like direct mail and telemarketing are often used for DM.

MRSs for marketing can be introduced for various reasons, some examples are given below.

- Promising new marketing media, such as CD-i and TV-Interactive (Frost & Sullivan, 1992), are used to convey the marketing message more effectively and to obtain direct response.

- New electronic services and products are provided with sophisticated and attractive user interfaces, so that they become self-marketing, for example, a news on demand service as part of a virtual market service that makes itself known to the subscribers of the virtual market service. The news on demand service can make itself known by giving some kind of a signal to the subscriber whenever he starts to use his virtual market service, or by being presented in a yellow pages services list. The signal might take the form of a short commercial popping up in a window.

- The creation of marketing actions can be supported effectively by MRSs that access marketing databases containing already available material, like product photographs, TV commercials, and product and service descriptions. One can imagine that already available video, photo and audio materials are retrieved from an archive and reused for a new marketing action.
• Direct access to market research databases may be needed as well as access to order systems offering sales figures and systems offering customer profiles for market research purposes. Marketers need to have a good view of current developments in their markets, the performance of product and service lines, and customer profiles in relation to their purchasing behaviour. For example, if external sources (for example, a graphic\textsuperscript{9} IDC, YankeeGroup or OVUM report electronically retrieved) indicate that a market segment is growing tremendously, but the order systems indicate that the company's product lines are underperforming then the marketers must take action. Now that 'time to market' is a competitive weapon, another example would be a system to obtain a fast graphic 3D presentation and textual explanation of a competitor’s new product. Such information can prove vital for taking the right counter measures in time.

Sales

Four main types of sales outlets are distinguished within PTT Telecom: personal sales, shop sales, telephone sales, and teleservice sales. For business to business sales, \textit{personal sales} contact by sales staff and account managers is extremely important. Medium and large firms, especially, enjoy such special attention. Smaller accounts are often treated in the same way as small consumers with less personal care than larger accounts. \textit{Shop sales} are an important sales outlet for the consumer market, via the Primafoon shops of PTT Telecom, and business market, via the PTT Telecom Business Centres. \textit{Telephone sales} are a kind of direct sales, because there is no retailer in-between the supplier and the customer. Telephone sales are an increasingly important sales outlet for PTT Telecom for the consumer and small order business market. \textit{Teleservice sales}, by means of systems such as Videotex, exclude the human intermediary, and uses completely automated financial transaction handling mechanisms. In the Netherlands, teleservice sales are mainly used for business to business applications.

For all types of sales the most important performance measures are presumably sales volume (output in units or in currency) related to costs (input), and customer satisfaction, which is a critical success factor and can be seen as a predictor for future turnover. MRIs are believed to be useful for raising sales volume per input costs, and improving customer satisfaction. The idea is that MRIs help to raise sales volume by offering a better presentation and more attractive explanation of services, by offering a more flexible service to customers and by improved customer satisfaction and customer relations. A highly flexible service means here a service that customers can purchase at any time, in any way, and from any location they want. For example, by shopping in the comfort of the living room at night when most shops are closed.

\textsuperscript{9}The graphic aspects are not essential, but help to interpret data faster.
MRSs can also help to reduce sales costs. An example is replacing sales staff with computerised sales assistants (point of sales or point of purchase) in the low service/low prices segment\(^\text{10}\) as a measure to cut sales costs with the loss of some quality of service. We can consider human sales assistance to be superior to computerised sales assistance, for this reason, human sales assistance will probably stay an indispensable service element in the high prices/high services market segments. In the high services/high prices segment of the business market it is not unusual to take customers to MM theatres and lavish on them commercial information that is pleasurable to the senses.

Policy & Support

In the case of PTT Telecom, policy and support processes are centralised, and are of a secondary nature. Here, only the policy and support processes that are relevant for the MRS for M&S discussion are elaborated in some more detail: public relations (PR), training, production of marketing information items, and the management of marketing information. **Public relations**, the main objective of which is to create a positive corporate image and stimulate free publicity, is a general supportive process. PR certainly has many similarities with marketing, for example, in the use of mass media. In the case of PTT Telecom, PR is performed by the IECT (Internal and External Communication Telecom) staff organisation. The diversity of sales people involved in the sales process requires tailor made training courses for specific target groups. More and more MRSs are used to support or replace training staff.

The production of marketing information items like conventional paper catalogues is an important task performed by catalogue editors. The catalogue editors need to retrieve marketing data from marketing archives and product information systems to update their catalogue with topical information. With the introduction of MM catalogues, catalogue production transforms into the production of MRSs.

Within large M&S firms like PTT Telecom marketing information represents a huge capital investment. It includes company videos, commercials, photographs (sometimes using expensive models), leaflets, catalogues, etc.; recently interactive products on new marketing media, like computer disks, TV-1 and CD-ROM, have been added to this list. The management of this marketing capital is performed by marketing archives. The main purpose of such archives is to stimulate reuse of material already produced and in this way save on costs, to facilitate quick marketing actions, and to be able to implement an effective quality control on marketing information to avoid damaging mistakes. MRSs in the form of archiving systems can support the management of this marketing capital.

Performance measures related to tasks and processes

The benefits in terms of improvements in the performance of tasks and processes need to be evaluated if MRSs are introduced in an M&S firm. Therefore we need to select performance measures. In the foregoing sections many of these performance measures have already been

\(^\text{10}\)For market segmentation see Mason *et al.* (1993)
mentioned. In the following three tables a structured overview is given of performance measures in relation to task and processes and the MRSs that are used to support meeting business objectives (target values of performance measures). Table 1 gives an overview of measures for marketing processes and tasks, table 2 gives an overview of measures for sales processes and tasks, and table 3 gives an overview of measures for supportive M&S processes and tasks.

<table>
<thead>
<tr>
<th>Process/task</th>
<th>Performance measure</th>
<th>MRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Management(^{11})</td>
<td>• Sales volume per product</td>
<td>Product IS (Information System)</td>
</tr>
<tr>
<td></td>
<td>• Id., but compared to a target</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Market share per product</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Expenses incurred per product</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Contributions of product to profit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Net profit of product</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Return On Assets committed to the product</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Quality of product/service information</td>
<td></td>
</tr>
<tr>
<td>Market and Marketing Research</td>
<td>• Insight into market tendencies and marketing mix variables</td>
<td>Marketing IS</td>
</tr>
<tr>
<td>Marketing actions</td>
<td>• Response rate (sales call)</td>
<td>Interactive media</td>
</tr>
<tr>
<td></td>
<td>• Gross Rating Point</td>
<td>Marketing archive system</td>
</tr>
<tr>
<td></td>
<td>• Awareness of product/supplier</td>
<td></td>
</tr>
<tr>
<td>Marketing intelligence</td>
<td>• Insight into customer behaviour</td>
<td>All sales transaction systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marketing IS</td>
</tr>
</tbody>
</table>

Table 1. Overview of marketing processes and tasks, related performance measures, and MRSs that are used to support these processes.

The effectiveness of marketing actions, which can be very costly, is strictly monitored by marketers. For example, if an advertisement campaign about Greenpoint is run by PTT Telecom it is vital to know how effective this campaign is in terms of changes in sales volume. Such information is input for decisions on using different marketing media or not, proceeding with the campaign or not, repositioning the product or not, etc. Useful performance measures for marketing actions are the response rate to a marketing action or the awareness of products or the supplier. If it is not possible to isolate response rate or awareness one can take a measure like Gross Rating Points\(^{12}\).

\(^{11}\)The listed product performance measures are based on an n=142 survey on 'Measures to Evaluate Industrial Marketing Activities' as described by Reeder et al. (1991).

\(^{12}\)Gross Rating Points = reach * frequency / total audience; where reach is the number of people exposed to one or more of the vehicles in the media schedule, and frequency is the average number of vehicle exposures each person will receive from a given media schedule (Aaker & Myers, 1987)
The performance of a product or service is also strictly monitored by product managers within PTT Telecom. We can think of performance measures like sales volume per product, market share per product, net profit of product, etc. In a more aggregate form this information is important for the management of an M&S firm because it shows the performance of the firm as a whole. Market(ing) research and market intelligence have more qualitative performance measures, namely insight into customer behaviour, insight into market tendencies, and insight into the usefulness of marketing mix variables for certain product market combinations.

<table>
<thead>
<tr>
<th>Process/task</th>
<th>Performance measure</th>
<th>MRS</th>
</tr>
</thead>
</table>
| Sales (in general) as related to customer performance | • Sales volume per customer  
• Same, but compared to target  
• Contribution of customer profit  
• Net profit of customer  
• Return On Assets committed to the customer |             |
| Personal sales | • Sales volume per salesman  
• Customer satisfaction | MM Presentation  
MM Catalogue  
MM Product IS |
| Shop sales    | • Sales volume per shop  
• Sales volume per shop assistant  
• Sales volume per MM kiosk  
• Customer satisfaction | MM kiosk  
Sales Support System |
| Telephone sales | • Sales volume per employee  
• Customer waiting time  
• Customer satisfaction | Sales Support System |
| Teleservice sales | • Transaction costs  
• Turnover per service hour  
• Customer satisfaction | Public MM Information  
Service |

Table 2. Overview of sales processes and tasks, related performance measures, and MRSs used to support these processes.

The sales force especially, is judged by its sales volume, net profit and customer satisfaction (see table 2). One can imagine that MRSs for sales processes and tasks should increase sales volume, cut costs to improve net profit, and improve the quality of service level to improve customer satisfaction. PTT Telecom investigates customer satisfaction often in both the consumer and business market with regard to its services, and publishes the results in the form of customer satisfaction barometers. In the near future, an MM teleservice may, if it

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13The listed customer performance measures are based on an n=116 survey on 'Measures to Evaluate Industrial Marketing Activities' described by Reeder et al. (1991).
really fulfills a market need and the infrastructure is publicly accessible, lead to a larger market share and higher turnover for M&S firms investing in it. M&S support processes and tasks are more diverse than operational tasks, and therefore the performance measures are also more diverse (see table 3). Costs are often important since back office tasks, policy making and M&S support tasks are often considered to be overheads. They are often considered to be overheads because they do not, directly and/or visibly, contribute to a better financial result. Declining margins on products and services are in many cases compensated for by cutting costs. Corporate image is an important PR performance measure and it can be determined by using large-scale surveys. Performance when training sales staff can be measured by testing product and service knowledge and skill level, by measuring training costs per trainee, and measuring waiting times for courses. The quality of information dimensions and the cost per produced information item, are particularly important for the production and management of marketing information.

<table>
<thead>
<tr>
<th>Process/task</th>
<th>Performance measure</th>
<th>MRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public relations</td>
<td>• Corporate image</td>
<td>Interactive media</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marketing archive system</td>
</tr>
<tr>
<td>Training of sales staff</td>
<td>• Product &amp; services knowledge</td>
<td>MM Aided Instruction</td>
</tr>
<tr>
<td></td>
<td>• Training costs per trainee</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Waiting time for course</td>
<td></td>
</tr>
<tr>
<td>Marketing Information</td>
<td>• Quality of marketing material</td>
<td>Marketing archive system</td>
</tr>
<tr>
<td>Management</td>
<td>• Delivery time of material</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Archiving costs per delivery</td>
<td></td>
</tr>
<tr>
<td>Production of</td>
<td>• Costs per information item (e.g., catalogue)</td>
<td>MM Catalogue</td>
</tr>
<tr>
<td>marketing</td>
<td>• Topicality of the information</td>
<td>MM Publishing</td>
</tr>
<tr>
<td>information items or</td>
<td>• Completeness of the information</td>
<td>Environment</td>
</tr>
<tr>
<td>systems</td>
<td>• Persuasiveness of the information</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Overview of M&S support processes and tasks, related performance measures, and MRSs used to support these processes.

2.2.5. Types of people involved

The types of people involved is an important characteristic of the framework. The effective support of M&S employees and their customers, by MRSs for M&S is fundamental to being able to meet determined business objectives.

What are the issues and characteristics of M&S employees that can be supported by MRSs? First of all, it is very important to note that most M&S employees do not want to interact with complex systems. Moreover, many personal sales people, and shop and telephone sales people within PTT Telecom, are relatively untrained IT users. So general M&S support
systems need to offer an easy to use interface. Usability testing (ISSUE, 1993b) is extremely important to develop the most efficient and effective retrieval interface. In the support departments of PTT Telecom, however, specialists who require more sophisticated functionality can be found. Such specialists like catalogue editors, archivists of marketing information, and market researchers, demand more sophisticated retrieval interfaces and it is affordable to train such a relatively limited group of people to handle the more complex functions of MRSs.

From the point of view of an M&S firm, one of the biggest advantages of MRSs is probably the shortening of the distance to the customer. This distance is shortened by using MRSs for direct marketing and direct sales. When considering general purpose MRSs for direct marketing or direct sales it is important to realise that business customers and private customers form a large and heterogeneous group.

In general, consideration of the diversity in customers leads to the selection of public systems that have a low threshold: they need to be very easy to use, cheap, and standardized (Gili Manzanaro et al., 1992). Easy to use implies polished MM interfaces with only simple retrieval options.

2.2.6. Type of information items processed

The type of information items processed is naturally an important characteristic of MRSs for M&S. Dur (1992) defines an information item as an object processed by workers during information processing tasks. The main purpose of ISs is the effective support of this information processing.

Many types of information items are processed within M&S organisations. In this section we focus on information items processed by MRSs. MRSs are used for the production, presentation and/or delivery of:

- primary information items, information items that are part of the output of the primary process of a firm, an examples is an information product like a telephone book on CD-ROM;
- secondary information items, information items that directly or indirectly support one or more primary processes of a firm; for example, information items forming a part of marketing actions (e.g., an advertisement in a newspaper for a mobile phone), customer care information items (e.g., a consumer catalogue), and M&S support information items (e.g., a manual for a telephone switch); these information items are by nature multimedial.

Information items in the M&S processes already contain all audio-visual information types in changing combinations. Therefore, MM is not really new for M&S, it just adds the interactive and combinatory dimension of MM technology. Interactive MM variants of non-electronic M&S information items are, for example, MM catalogues, interactive TV commercials, and interactive MM business presentations. The number of interactive MM variants on non-electronic information items is growing rapidly. These MM variants have in
common that they are useful as marketing media, because of their audio-visual nature. Since these marketing media are relatively new, no consensus as yet exists about the qualitative media effect. The qualitative media effect is defined as what the medium does to enhance or depreciate a message after the medium has delivered the message (Burnett, 1992). Interactive marketing media have a more sophisticated outlook, and are positioned as 'innovative' by several advertising agencies promoting the use of these marketing media. If an M&S organisation prefers to promote a conservative and sober image, interactive marketing media may not be the best choice.

2.2.7. Type of M&S Support Systems

When characterising an MRS for M&S it is useful to identify what type of M&S Support System it is, and what types of other M&S Support Systems are involved. It is useful for two reasons. First, this characteristic makes it easy to identify similar systems and to make comparisons between these systems. If MRSs are introduced the value added of these systems when compared to their non-MR predecessors should be convincing as it should not be forgotten that ISs (here MRSs for M&S), should contribute to a more efficient and effective functioning of the organisation (Sol, 1988). Second, it is important to be able to identify interfaces with related M&S Support Systems. So, the types of M&S Support Systems is a useful M&S characteristic. Several types of M&S Support Systems are present:

- marketing ISs;
- business presentation systems;
- electronic catalogues;
- sales support systems;
- MM kiosks;
- teleshopping systems;
- commercial on-line marketing databases;
- sales training systems;
- electronic catalogue publishing environments.

These M&S Support Systems, which often have an overlap in functionality, are discussed below in more detail.

Marketing IS

Jain (1990) describes a Marketing IS as an IS which offers a formal way to structure the information flow through the three modes: marketing intelligence, market research, and marketing research. Marketing ISs give information about market potentials, consumer and customer attitudes and behaviour, distribution channels, communication media, market sources, and new products. Moreover, Marketing ISs give competitive information, information about foreign exchange, prescriptions and laws, resources, and general (e.g., macro economic) conditions. MR aspects of Marketing ISs include, for example, retrieval of illustrated documents like market forecasts by market research institutes, newspaper and magazine articles, annual reports of competitors and business partners, or marketing plans.
Chapter 2. Framework for Multimedia Retrieval Systems for Marketing & Sales

Business presentation system

Business presentations of products and services are given at conferences, fairs, and for large accounts by account managers and personal salesmen. MM presentations (Hooper Woolsey, 1991) meet the demands of sophisticated audiences for high quality packaging of the message. Since, the quality of a presentation can make the difference between receiving or missing an order, some sales people are eager to use such sophisticated presentation systems, for example, Macromedia Action! from Macromedia and Harvard Graphics from Software Publishing Corporation.

Presentations of products and services can also be given in shops. On-going video's are well known, but boring. Interactive presentations, at the other hand, are more fun. These interactive presentations are used to support shop personnel in their customer contacts or are used by customers on themselves.

Electronic catalogue

An electronic catalogue, is the electronic and interactive variant of a paper catalogue. It offers product and service descriptions, illustrations, technical explanations, selling arguments, price information, etc. An important advantage of on-line electronic catalogues is that they can be kept highly topical. For example, they may contain the most recent prices. (Fast outdating of prices is the reason that prices are omitted from most printed catalogues, which is annoying for customers and sales staff who have to look-up prices on separate price lists). MM and retrieval capabilities are another advantage of electronic catalogues, enabling effective presentations and effective retrieval. In the case of off-line electronic catalogues, the low reproduction and distribution costs of large circulations of CD-ROM based media is money saving. This is the reason why IT suppliers like Digital Equipment Corp. deliver their high end products only with accompanying electronic manuals on CD-ROM in stead of shipping stacks of paper manuals to their customers. For mail order companies, like Wehkamp in the Netherlands, it is cheaper to produce their glossy catalogues on CD-ROM or CD-i rather than in an expensive paper version. As soon as their customers have the right infrastructure at their disposal, it will be useful and far less expensive to produce only electronic catalogues. Only in case of very sophisticated MM catalogues is the production cost of the electronic version much higher than those of a paper version.

On-line MM catalogues (Philips, 1993) are in their infancy. A hybrid example is the IBM Direct catalogue on CD-ROM offering large accounts access to the complete IBM assortment and on-line ordering functionality using a modem. Large accounts can also online download the IBM Direct catalogue.

Sales Support System (SSS)

Sales Support Systems are ISs that include all relevant information for sales employees to support their tasks, like preparing for sales conversations, demonstrating products and
services related information, intake of orders etc. SSSs offer among others, access to assortment information, an order entry module, a complaint registration module, and a news module giving topical information about current marketing actions. Management information can be aggregated from the order database to monitor sales performance by sales managers, product managers and marketers. Reeder et al. (1991) stress the importance of sales force automation to make sales employees more productive, to help the sales manager to manage the sales force more effectively, and make relations with customers more profitable. MR aspects enter SSSs when, for example, illustration material is included, and sales data needs to be visualised for sales managers and product managers. One can sometimes note the inclusion of a picture of a customer (contact person) for identification.

**MM kiosk**

An MM kiosk, in the form of a Point Of Information (POI), a Point Of Purchase (POP) or a Point Of Sales (POS) system (Josefsson, 1991), is a replacement of or a support tool for a sales employee. An example of this is the POI called Futuropolis with marketing information about subscribing firms, which was placed in libraries in 1994 (Explainer, 1993). As an example of another POI one can imagine an MM kiosk in a do it yourself shop, that allows customers to select materials for their home renovation by trying them out in the kiosk, which visualises the effects. If the kiosk includes a transaction component it becomes a POS; the MM kiosk at the Dutch flower exhibition (Floriade), allowing the user to order tulip bulbs, and to pay for them by credit card or debit card is an example. If the kiosk is able to deliver the products instantly it becomes a POP. A POP can be compared to the classic *vending machine*. Vending machines now sell products ranging from coffee and cigarettes to personal care products and tickets, and are located in factories, offices, hospitals, public locations, etc. We can imagine that the user interface can be improved by an MM display of products, and that more products can be purchased by POPs than is the case now with the current generation of vending machines. A good example of a POP is an MM kiosk which shows fragments of video films that can be selected by a customer. If the customer makes a selection and pays for it, the video is instantly recorded on a video tape and spat out after a few minutes.

As an M&S aid, MM kiosks are extremely effective in drawing attention to what is being sold or promoted (Templeton, 1993). Roper (1993) gives a number of examples of MM kiosks for retail where the implementation of MM kiosks leads to gains in efficiency, to increases in sales volume, and to an improved quality of service. An MM kiosk can contain catalogue information and other marketing information, company information, game elements for attractiveness reasons, and a transaction module for ordering and paying. Since customers really want to purchase and buy something with an MM kiosk, the transaction module is extremely important. Roper (1993) sees the use of a card payment system (credit cards, travel cards, etc.) as a vital element of retail automation with MM kiosks. One of the advantages of an MM kiosk is that it offers the possibility to show a *broad variety* and a *deep assortment* of items without the need to physically expose these items in a large shopping area and keep them in stock.
Teleshopping system

Teleshopping is still in its infancy, although about 5,000 electronic shopping systems in the US provide information and transaction services in diverse industries, including gaming (lotteries), ticketing (airlines), travel services (hotel reservation), and general merchandise (cosmetics, fashion wear, consumer electronics, home improvement, and small appliances) (Mason et al., 1993). In Europe teleshopping is particularly advanced in France where French Telecom distributed their Minitel Videotex terminals for free.

In the Netherlands, business to business teleshopping and teleordering is growing faster than teleshopping by consumers. This may change with the introduction of MM. TV-I systems, like TV Answer from TV Answer Inc. (Frost & Sullivan, 1992), offer a more sophisticated user interface to consumers. AT&T started a TV-I market test in Orlando in 1994, that is drawing world wide attention. Consumers can interact with TV programs, like commercials, by using their remote control in combination with a Silicon Graphics graphical user interface displayed on their TV. They can request background information and place an order. These systems are also used outside the M&S sphere, for example, for voting. A fundamental question is whether consumers will accept these systems or not. If the answer is positive, then investment in teleshopping systems will probably show a snowball effect.

Commercial on-line marketing databases

Access to commercial on-line marketing databases is a valuable extension of a Marketing IS, since these external data sources help to perceive market trends and developments. A study by Reeder et al. (1991) with responses from thirty-four large US firms, each with over 5,000 employees and over $100 million in sales, indicated that computerised data sources are used an average of 61.2 times per year by each firm, an average far exceeding that of any other secondary data source. Examples of commercial on-line databases are the Dow Jones News/Retrieval with up to the minute business and financial information, Inspec with article descriptions on technical subjects, Disclosure Database with extracts of more than 12,000 companies based on their Securities and Exchange Commission reports, and electronic and interactive versions of newspapers like The Wall Street Journal and The Washington Post (Lesly, 1993). Slowly, commercial on-line databases are offering MM data and a higher level of interactivity. This is true for Disclosure and the electronic newspapers which need to compete with printed versions on attractiveness and ease of use.

Sales training system

Sales training systems are receiving more and more attention. In general, one speaks of MM Assisted Instruction (MAI) as a continuation of Computer Assisted Instruction. Heller (1990) speaks of Hypermedia Assisted Instruction when hypermedia facilities are also

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14 Secondary data is data that already exists, not having been prepared for the specific problem at hand, this is in contrast to primary data.
The Viability of Multimedia Retrieval Systems for Marketing and Sales

included. The tremendous R&D interest in Hypermedia Assisted Instruction justifies this distinction (Hoogeveen, 1993b). The reasons for the introduction of MAI for sales training systems are that these systems are believed to:

- be more time effective, for many types of trainees, than conventional courses (Nicolson et al., 1991);
- save training and travel costs when they replace conventional courses and human teachers (Kustermans, 1991);
- reduce course waiting time for new sales people when the training capacity is limited.

Catalogue publishing environment

Within PTT Telecom the production of a variety of catalogues to support its diverse sales force, is performed partly in house. The editing of catalogue texts, graphics, images and the lay-out is performed using software and hardware tools, which together, form an electronic catalogue publishing environment. With the rise of electronic MM catalogues the need for MM publishing facilities has grown. Small companies can put out the job to MM publishing subcontractors, larger companies like PTT Telecom tend to retain more control over the publishing process, and contract out less.

The production of MM catalogues is a specialist job. The retrieval facilities need the special attention of database & retrieval specialists, and human factor engineers (ISSUE, 1993a). As these types of expertise are becoming increasingly available within the market, the setting up of an in house MM publishing environment is now within the reach of a large company like PTT Telecom.

2.2.8. Conclusion

A number of business characteristics of M&S situations are discussed in relation to MRSs in the foregoing sections. These characteristics seem useful as part of a descriptive framework for MRSs for M&S. The characteristics are not completely unique to my research domain, nevertheless, domain specific accents can be distinguished.

In summary, I argue that the M&S business characteristics of MRSs can be described in terms of:

- meeting vital M&S business objectives in terms of efficiency, effectiveness (especially quality of service), productivity or meaningfulness; more specifically M&S business objectives can often be formulated in terms of reaching a certain level of marketing performance (e.g., a certain minimum response rate for a marketing action) or sales performance (e.g., a higher sales volume per sales employee).
- the types of products and services provided by the M&S firm and represented in the MRS; in the case of innovative MR services and MR products MRSs are also required to develop and deliver these products and services;
- the types of M&S tasks and processes supported (grouped into sales, marketing, and policy & support) in relation to performance measures; in general, one can also
distinguish between primary and secondary, and structured and ill-structured tasks and processes;
- the types of people involved that need to be supported by MRSs for M&S, like marketers, shop assistants, telephone sales assistants, and their private and business customers; with regard to the level of IT expertise necessary to use MRSs one can distinguish between IT specialists, general IT users, and public IT users;
- the types of information items processed; these can be part of the MR products or MR services delivered, and are used for marketing, for customer care, or are used to support the marketing and sales staff;
- the types of M&S Support Systems that are upgraded towards, or replaced by, MRSs for M&S, or need to be connected to MRSs for M&S.

![Diagram](image)

Figure 3. Summary of characteristics of MRS for M&S at the business level.

### 2.3. Developments in Multimedia Systems (MSs)

#### 2.3.1. Introduction

In the introductory chapter 1, I stated that MRSs for M&S are Multimedia Systems (MSs) with a clear retrieval component, that supports one or more M&S processes. An MS is an information system used to process or present MM information. In this section the developments which characterise MSs are discussed, in order to identify the most discriminating MS elements for the framework.
According to OVUM (Jeffcoate et al., 1993) the market for MSs is growing fast. MSs are being developed for a still growing number of application fields (Hoogeveen, 1993a). M&S is one of the most promising business application fields. It is very important to note, for the growing acceptance of MSs, that the price/performance ratio of MM products and services, MM hardware and software, is improving sharply. One can argue that when the prices for MM products and services drop to the level at which non-MM predecessors were accepted by the market, MM products will enter the office and the home in the form of upgrades and replacement investments. An example of such a process is that the current generation of PCs shipped - the 486 PCs, the Pentium-PCs and Power PCs - meet Multimedia PC requirements. They can be easily upgraded with a CD-ROM player and audio and video boards for more demanding MM purposes.

With the further evolution of MSs, and a further increase in processing, storage, transmission and functionality, it is believed strongly that a transition from MSs to Virtual Reality systems will gradually take place (Ramanathan et al., 1992; Vermeulen et al., 1993).

In general, the development of MSs meets the need of people to be more free in what information they process and how they process that information. One can see an MS as any integrated system which combines seamlessly, the data processing functions of the computer, the video and the audio processing functions of the TV and audio set, and the communication function of telephone platforms within one system. Hence, MSs are really characterised by the integration of many heterogeneous ITs (TTP, 1992). If one uses human perception as a metaphor an MS is an IS with a voice, with ears, with eyes and with some basic intelligence for natural language processing.

The developments in MSs also meets the need of people to have more and more functionality at their fingertips, independent of space (where you are) and time (when you want to do something). A sales person can communicate (talk, fax, mail, retrieve etc.) at his office, on the way to an appointment, at home or elsewhere. Instead of watching TV programs selected by a broadcasting company we can put together our own personal program and select, from an electronic videotheque, the videos that we want to see for a time that suits us.

An important, related tendency is that IT products are becoming more and more personalised, for example, Personal Digital Assistants (PDAs) and Personal Intelligent Communicators (PICs). PDAs are very small computers with pen-interfaces and simple versions of PC applications. Due to a lack of quality in the handwriting recognition software they are not as yet well-received in the market. PICs are similar products that support, for example, sending wireless a fax from the beach. The idea is that we can take these products along in our pocket, as we would an agenda, and that they support us in our routine tasks. With every new generation these products become more easy to handle and more powerful. Extrapolation of these developments may lead us into an ubiquitous computing future. In such a future one can imagine ubiquitous computing environments in which
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science fiction realities of talking and listening computers with multimodal\textsuperscript{15}, intelligent and powerful decision support (Sol, 1982; Sol, 1991) features are real. We should, however, be cautious not to overestimate such IT developments.

As stated, an MS is an integrated system for data processing, audio and video processing and communication. This does not imply that we move towards just one single integrated MM platform, one can note a proliferation tendency as opposed to an integration tendency: with the combination of TV, computer and telephone technologies many new hybrids come into existence. Examples of hybrids are:

- a computer with telephone functions;
- a telephone with a built-in computer for storing addresses and a screen for viewing one's conversation partner and presenting discussion documents;
- a TV with modem connection for passing on viewer responses and computing power in set-top boxes for gaming and teleshopping.

Such developments with regard to the three platforms mentioned lead not only to excitement, but also to a lot of market confusion and a constant cry for standardisation, however, \textit{de jure} (official) standardisation itself often contributes further to the confusion, since it is not clear in all cases if \textit{de jure} standards will be accepted by industry and the market.

In the following sections the definition of types of media given by the ISO work group MHEG (Multimedia and Hypermedia information coding Expert Group) are used as a thread. Next, the main MM processing elements of an MS are discussed from a functional perspective, and finally, the MS characteristics which are included in the framework are summarised.

\subsection*{2.3.2. Types of media involved}

The term \textit{media} is used here in the sense of \textit{means to transfer and distribute information}. Discussions about MM often lead to a Tower of Babel. MHEG (ISO/IEC, 1992b) distinguishes five \textit{types of media} (see figure 4): perception, representation, presentation, transmission and storage media. I define MM as the integration of multiple perception media (information types). To process MM information, an MS needs to support multiple representation media. Though not unique to MSs, it is often necessary that they need to make use of multiple presentation, transmission and storage media. Before defining and discussing these types of media it is important to note that MSs make heavy demands on the storage, processing and transmission capacities of the IT products involved. This is due to the size of MM files and MM data streams (e.g., one second uncompressed video results in a file of 20 MB).

\footnote{Multimodal here means that multiple modes of human perception are addressed by computer systems: i.e. the visual mode, auditory mode, haptic mode, etc.}
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Figure 4. Types of media after MHEG (ISO/IEC, 1993).

Perception media or information types

MSs are multimodal in the sense that they can handle and present multiple perception media or information types \(^\text{16}\) (see figure 5). A perception medium is the nature of the information as perceived by the user (ISO/IEC, 1993). I prefer to use the term information type instead of perception medium, as the latter is rather ambiguous from a psychological perspective. Information types can be grouped according to our perceptual senses (see figure 5). At the leaves one can find information types\(^\text{17}\) like speech, music, text, graphic, still, animation and video. Auditive and visual information types especially, are included in MSs, but this can go further as is shown by Virtual Reality systems. Mixes of these information types are present in information objects: documents, files, and records. A monomedia information object contains information of just one information type. MM information objects are often composed of a number of related monomedia objects.

It is interesting to note that mixed information types also exist. For example, Teodosio & Bender (1993) review salient video stills. Salient video stills are images that do not represent one discrete moment, as does a photograph or single video frame. Rather, one

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\(^{16}\)Within MM literature often the word 'medium' is used, but this is avoided here because of its ambiguity.

\(^{17}\)Information type is used here and in what follows, as the term perception medium is somewhat ambiguous.
image reflects the aggregate of temporal changes that occur in a moving image sequence with the salient features preserved.

**Figure 5. Types of information types.**

**Representation media**

To handle and present multiple information types, multiple types of representation media must be defined and supported. A representation medium is the type of the interchanged data, which defines the nature of the information as described by its coded form (ISO/IEC, 1993). In general, for all information types at the ends of the graph in figure 5 separate representation media are defined. Examples of representation media are ASCII for text, JPEG\(^\text{18}\) (ISO/IEC, 1991c) for photographs, and MPEG\(^\text{19}\) for video and audio (ISO/IEC, 1992b). One of the most important functions of representation media is that they offer a means for more efficient storage and communication of information. For example, MPEG1 coding can result in a compression with a factor 100-150, and JPEG coding results in a compression with a factor of about 30. Without coding many of the current MSs would not be able to function, because of technical limits to processing, storage and transmission capacity.

Representation media for MM are improving fast:
- Coding is becoming more efficient.
- The quality of the coded information is improving.
- More complex MM objects can be coded, e.g., HyTime (ISO/IEC, 1991b) for MM documents and MHEG (ISO/IEC, 1992b) for streams of MM objects.

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\(^{18}\)Joint Photographers Expert Group  
\(^{19}\)Moving Pictures Expert Group
• Standards for representation media are becoming more and more accepted. This is clearly the case for MPEG1 videos.

Presentation media

A presentation medium is the type of the physical means used to reproduce information to the user (output device, e.g., TV monitor or loudspeakers) or to acquire information from the user (input device, e.g., video camera or microphone) (ISO/IEC, 1993). The quality of the visual and auditory input and output are extremely important for MM purposes. Depending on the type of MS there are heavy requirements for the presentation media used. Some examples can be given. If photographs need to be judged then a high resolution monitor and printer are needed. If the presentation quality for commercial target groups is extremely important, one may consider CD-quality audio and TV-quality video output devices.

Transmission media

A transmission medium is the type of physical means used to transmit data (e.g., coax cable, telephone cable, etc.) (ISO/IEC, 1993). MSs with a communication component have some important functional requirements for transmission media. These are related to the transmission bandwidth, the reliability (inversely related to the fault rate), the transmission delay, the permitted information types, and the permitted (network) topology. The most specific requirements for MM are the need for integrated data communication (not just separate speech or video) and the need for much higher bandwidths. Newly developed transmission media meet these requirements, but current communication infrastructures often fall short in meeting these requirements, particularly the bandwidth requirement. An overview of transmission media for MM communication is given by Peeters (1992).

Storage media

A storage medium is the type of physical means used to store data (ISO/IEC, 1993). Storage media are not only used to save and back-up data, but also to distribute data. The use of MM information puts heavy requirements on storage media, because of the size (in bytes) of MM files.

• Large storage capacity: at least some hundreds of megabytes. (E.g., 1 hour of MPEG1 compressed video and audio usurps about 700 MB $\left(\frac{1.544 \text{ Mbit/s} \times 3600 \text{ sec}}{8 \text{ bit/byte}}\right)$ of media space.

• Short access time: because of their size MM data streams put a large burden on response times. The access time needs to be short for this reason. Tens of seconds may be acceptable in some cases, but tens of milliseconds is often more acceptable.

• High throughput: the storage media must allow for a throughput that is related to the level of quality of content data. MPEG1 quality needs about 1.544 Mbit/s (the
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indicated bitrate is between 0.384 and 10 Mbit/s). MPEG2 is meant for a high quality video; the indicated bitrate is 1.5-100 Mbit/s.

There are several types of storage media which meet these requirements: magnetic, optic, and magneto-optic. Developments in storage media are moving fast, and will, sooner or later, lift the storage bottlenecks with regard to these three requirements. The use of storage media for MM are discussed in detail elsewhere (Hoogeveen, 1993a).

2.3.3. Multimedia information processing

An MS is more than just several types of media put together in one system, because there are many additional MM information processing functions present in an MS. This is illustrated by the figure below, showing a stylised MM information processing cycle in relationship to the types of media discussed in the previous section.

We can distinguish several groups of MM information processing functions:

- **Input, digitisation and coding.** Information, containing various types of information, forms the input of an MS. One can think of manual text input, speech input, video input, etc. As most MSs are digital, the input information needs to be digitised (Analogue to Digital Conversion) if this has not already been done. In the case of text input the coding of information is sometimes performed directly after digitisation in the form of optical character recognition for the recognition of machine writing, and intelligent character recognition for recognition of handwriting. Edited or ready to use audio-visual information is coded (represented) using compression algorithms to reduce the size of the audio and video files.

- **Editing.** Most MSs offer some kind of an editing function for the editing of content data. In the case of audio and video it is necessary to edit the digital data files before they are coded, as quality is lost every time audio and/or video data is coded or decoded. Some examples of editing are text editing, graphic design, animation production, video and audio editing. This may include, for example, SGML-editors, MHEG-editors, MPEG-editors, or just popular word processors. MM desk-top publishing also includes editors for the composition of data objects. An example of such an editor is a presentation editor or a CAD/CAM editor. Editing is also an important part of any authoring process of an MM title or MM application. Specialist interface designers, audio and video engineers, graphic artists, etc. need to be supported in their creative tasks.

- **Authoring.** Coded information forms the input for the authoring process, by which an MM title or application is produced. During the authoring process a set of authoring tools, for the composing of an MM document or hypermedia document, are used to put together the edited information objects, and to program the user interaction.

- **Storage, maintenance and retrieval.** The MS updates (adds, changes, deletes) the MM information in an MM database. This subject is not elaborated in much depth here, as the subject is discussed extensively in section 2.4. The MM database is stored or archived using one or more storage media, and needs to be managed. MM information
can be retrieved from storage media distributed physically or retrieved on-line (using transmission media) by users of the MS.

- **Presentation.** To present MM information the information needs to be decoded, converted to analogue and presented by one or more presentation media to the user. The way MM information is presented to the user and the choice of presentation media should be well adapted for the function the MS has for its users.

![Figure 6. Stylised functional relationships between media types and the processing cycle of MM information.](image)

More key IT technologies are involved, between input and output, in MM processing than discussed. Some of these are:

- VR technology for 3D visualisation and human gesture interpretation;
- visualisation (or simulation) for visualising complex data;
- intelligent user agents for helping users with the execution of tasks;
- object orientation for more natural organisation of information and use of software;
- image processing for the digitisation, analysis and interpretation of images;
- speech technology for speech recognition, speech synthesis, and speech response;
- natural language interpretation for the parsing and translating of written and spoken language(s).

### 2.3.4. Conclusion

In the foregoing sections MS characteristics are discussed as part of the descriptive framework for MRSs for M&S.

To summarise, MS characteristics of MRS for M&S can be described in terms of:
- the perception media (information types) used to describe the nature of the M&S information processed by MSs;
- the types of MM information processing elements, functional elements of MSs.

These types of MM information processing elements are grouped as follows:
- input, including the digitisation and coding of MM information;
- editing of monomedia and MM information objects;
- authoring of MM titles and MM applications;
• storage, maintenance and retrieval of MM information in MM databases;
• presentation, including the necessary decoding and digital to analogue conversion.

The types of media (representation, presentation, transmission and storage media) distinguished are subordinate to these functions.

![Diagram](image)

Figure 7. Summary of characteristics of MRS for M&S at the system level.

2.4. Development in retrieval systems

2.4.1. Introduction

In chapter 1, I argued that retrieval technology is a key technology for MRSs for M&S, as it is for ISs in general.

Nowadays, DataBase Management Systems (DBMSs) form the 'retrieval engine' of the database systems\(^{20}\) of most ISs. A DBMS supports the storage, indexing, maintenance, access, and retrieval of data by an IS. Today, many DBMSs support the relational model. DBMSs supporting a hierarchical or network data model are seen as obsolete, although many large corporate database systems are still based on the latter two models.

Well-known DBMSs such as ORACLE, INGRES, INFORMIX and DB2 were originally designed for the management of databases having structured data. *Structured data* is data which is structured into tables and the meaning of which depends on data definitions. This contrasts with *ill structured data*\(^{21}\) in documents, videos, music recordings, pictures etc.

In the past few years, leading DBMSs like ORACLE and INFORMIX have advanced in the direction of MM DBMSs (MDBMSs) by the implementing of storage and retrieval of

\(^{20}\)Database system = retrieval engine(s) + database(s)

\(^{21}\)I avoid the often used term unstructured because it is misleading: texts can be structured into sections and chapters, within a pictorial image certain objects can be distinguished, and music and speech also have their own structures.
binary large objects. SYBASE is an early example of this. Binary large objects may contain any large data file: a video file, a document file, an audio file, etc.
Most MDBMSs handle binary large objects as black boxes: it is not possible to search on the content of binary large objects, even if it contains text. This is because most DBMSs do not support advanced information retrieval facilities like full text indexing, use of inexact query arguments, and pattern recognition (Hoogeveen, Van der Meer & Sol, 1992b). Support of these, and supplementary facilities, is still the domain of Information storage and Retrieval Systems (IRSs). Examples of IRSs are BRS/Search from BRS Information Technologies, BASISplus from Information Dimensions Inc., and TOPIC from Verity.

Four main types of IRSs can be distinguished:

- **Reference Systems**, e.g., automated catalogues, these are used to keep track of external sources of information, whether digitised or analogue. These information systems contain references to books, documents, articles, audio and video tapes, etc.
- **Document Image Systems** or **Optical Filing Systems** are IRSs where every page of a document is scanned and stored as a bitmap in binary files. Document pages can be retrieved by keyword searches.
- **Full Text Systems**, where the complete texts of documents are indexed and can be searched.

Multimedia Document Systems, Document Image Systems and Optical Filing Systems sometimes offer hypermedia facilities. These facilities stem from Hypermedia Systems (HSs) like HyperCard from Apple Inc. The 'hyper' prefix indicates that non-sequential access to trunks of information by tracing hyperlinks within a document is supported (Frei & Schäuble, 1991). It is important to note that most HSs and IRSs lack the power of DBMSs for handling structured data.

MRSs for M&S make use of a customised retrieval engine (an MDBMS), this sub-system can be described in terms of its integrational approach to handling multiple information types and the essential retrieval facilities that are (indirectly) offered to the users of an MRS.

### 2.4.2. Types of MDBMSs

The retrieval engine used by an MRS for M&S will, in most cases, be an MDBMS, which can be characterised by the integrational approach (Saxton & Raghavan, 1990; Hoogeveen *et al.*, 1992b) followed to combine heterogeneous retrieval facilities for the different information types. These approaches are listed below.

- **Standard DBMS approach**. A standard DBMS is used, and MM files are stored in directories. Additional MM database management is included in an application on top of the standard DBMS. If wanted, information retrieval facilities can be newly created...
as an application on top of a standard DBMS (Macleod & Crawford, 1983). A major disadvantage is that it is not possible to profit from low cost, ready for use, standard MM database management and IRS facilities. Therefore, this approach does not seem viable today.

- **Extended DBMS approach.** A DBMS is extended with MM database management facilities and, if necessary, with some IRS facilities (Saxton & Raghavan, 1990). An example is the introduction of an 'image' data type enabling storage and retrieval of medical images (Jasinsky et al., 1987). Leading RDBMS suppliers, such as ORACLE, are extending their RDBMSs with MM storage and presentation facilities. Object Oriented DBMSs are most closely related to this second category: they enable storage of complex data types like MM documents, often offer no further IRS facilities, and use an object oriented Data Modelling Facility instead of a relational one. Due to the economic significance of the DBMS, and heavy competition between mainstream DBMS vendors, the importance of the extended DBMS approach should not be underestimated.

- **Extended IRS approach.** Research within this category has concentrated on the development of Multimedia Document Systems (Bos & Van Wijk, 1993), extending IRSs with MM features, and adding the relational model to an IRS (Crawford, 1981; Agosti et al., 1989). TOPIC is an example of an IRS supporting some MM presentation facilities.

- **External integration approach.** An MDBMS is formed by embedding several retrieval engines into a common environment, for example, a DBMS for structured data and a Multimedia Document System for ill structured MM data. A front end like UNIFACE is a commercial example of a software environment that supports the access of multivendor databases, including some IRS databases. Such a front end is useful to combine retrieval engines without the need to put much effort into the development of interfaces for the retrieval engines.

- **Full integration approach.** An IRS and a DBMS are merged into one hybrid database management system and extended with MM database management facilities. The MDBMS BASISplus from Information Dimensions Inc. (1990), little known outside the text retrieval world, is an example of this approach.

It is important to stress that the extended DBMS approach is most often followed by suppliers, in general, therefore their products are the most mature.
Figure 8. Data flow diagram of the retrieval engine at the heart of an MRS.
2.4.3. MDBMS facilities in support of an MRS client application

The MDBMS facilities that support database related functions at the heart of an MRS are discussed in this section. In figure 8 a graphic overview is given of database related functions supporting an MRS client application, a database administrator and communication with external ISs.

Data Modelling Facility

The Data Modelling Facility (DMF) supports the database administrator in data modelling: updating both the data definition database, and the index and MM databases. The modelling of MM data is as yet, in its infancy. Therefore the data modelling capabilities of a retrieval engine selected for an MRS for M&S need special attention.

An advanced DMF is one of the most distinguishing features of DBMSs (ISO/IEC, 1991a). The DMF is a facility that provides for the execution of statements specified in a data definition language (DDL)\textsuperscript{22} and a data manipulation language (DML)\textsuperscript{23}. A major strength of the DMF of DBMSs is the capability to define data integrity constraints (attribute, entity, referential, and database integrity). In many cases the DMF will support Codd's (1970) relational model. IRs do not offer such an advanced DMF. Usually data modelling in IRs is restricted to classification of objects. This means that some attributes are used for identification codes and keywords describing, for instance, an X-ray in a medical imaging system or a video in a video catalogue. An alternative for, or an addition to, a relational DMF is an object oriented DMF (Weigand, 1991; Kikkers, 1992). An object oriented DMF is sometimes fit for modelling complex MM objects, which is definitely not the case for conventional DBMSs and IRs. Today, relational MDBMSs offer special data types for large objects containing MM data: an image data type, a document or text data type, and a BLOB (Binary Large Object) data type.

Many DBMSs offer SQL (ISO/IEC, 1989b) as a standard database language that determines, among others, a DMF for relational structured data\textsuperscript{24}. SQL is non-procedural, meaning that statements do not need to be processed in a fixed order. It is important to note that SQL is unfit for the definition and manipulation of free text, graphics, image, audio and video. Therefore, current MDBMSs sometimes offer extensions of SQL or SQL-like database languages. The minimum extension needed includes functions for defining and manipulating BLOBs containing MM data.

\textsuperscript{22}The DDL is used to specify the schemes of the database. A schema is a collection of data definitions that determine the structure and constraints of the data present in the database and are stored in a data dictionary.

\textsuperscript{23}The DML is used to specify processes which may be performed on data, structured according to the database schemes.

\textsuperscript{24}Examples of DDL statements from SQL are CREATE SCHEMA, CREATE TABLE and CREATE VIEW. Examples of DML statements from SQL are INSERT, UPDATE and DELETE.
Search facilities

MM search functions need to be offered to users, for efficient and effective retrieval by an MRS. Such search functions often rely on the search facilities of an MDBMS. The limitations of DBMS search facilities and IRS search facilities, and the MM extensions needed and offered by MDBMSs, are discussed below. To select or judge an MDBMS as a retrieval engine for an MRS it is important to have insight into the search facilities supported. These need to match the search facilities needed.

Within DBMSs, SQL is used as query language, that is offered directly to the user, or via a Query By Example screen. As a query language, SQL can be called an exact query language, since one can predict the results of a query on a database, assuming that the database is not corrupt. It is important to note that SQL is not able to handle the retrieval of free text, graphics, images, audio and video. It is necessary for MM retrieval, to extend a query language by the possibility to retrieve MM objects.

When text documents are stored in the database, and there is a need to retrieve these documents effectively it is worthwhile to consider IRS search facilities: inexact query mechanisms, incremental searching using set manipulation, ranking and clustering, and search profiles.

Inexact query mechanisms of IRSs, discussed extensively by Salton (1989), tackle the text retrieval problem in static text databases. An inexact query language offers the possibility to truncate search terms, to mask characters to overcome for instance spelling variations, and the use of special search operators like Adjacency (i.e., search terms are next to each other) and Proximity with its various implementations (Keen, 1992).

It is a major text retrieval problem that a result set containing references to all relevant (100% recall), and no irrelevant (100% precision) texts is definitely not within reach of current inexact query languages. In their classic experiment, Blair & Maron (1985; 1990) described a situation with 350,000 full text indexed pages, where recall and precision for queries were typically 20% and 79% respectively, and values over 50%/50% were absent.

An incremental search strategy can be followed by a user to by-pass this text retrieval problem. A set manipulation facility, linked to the inexact query language, is provided by some IRSs for this reason. Set manipulation is used as follows. After a query a result set is produced containing zero or more members (i.e., found documents). One or more of such result sets can be used as input for new queries. In this way users can navigate through a database by combining, restricting or extending their result sets until their final result set satisfies them.

Another approach to tackle the text retrieval problem is to improve the recall and precision percentages using thesauri. Thesauri can be used to enhance user queries, but can also be used for field validation. A thesaurus contains a controlled list of index terms, using this list of index terms an attempt is made to overcome language problems such as spelling variations, use of punctuation marks, use of homonyms and synonyms, use of identifiers or popular names instead of scientific or official names, etc. (Aitchison & Gilchrist, 1987). Two international standards, ISO 2788 for monolingual and ISO 5964 for multilingual
thesauri, specify the features a thesaurus should offer for building a semantic network of relations between terms. The ISO standards also describe the permitted types of relations. Still another approach to by-pass the text retrieval problem is ranking. With ranking, a statistical probability of relevance is used to assign a rank to a certain document with respect to a given query. Retrieved documents are presented to the user in order of relevance.

In the case of dynamic document flows and users with a stable and well-defined information need search profiles can be created, specifying a field of interest. IRSs that support search profiles can present lists of new documents automatically to users corresponding to their search profile. The definition of a search profile is, however, not without problems. Foltz & Dumais (1992), testing their information filtering method, observed that documents were rated as relevant that did not share any word with the search profile!

Ideally, an MDBMS would allow for pictorial retrieval, for example, when searching for videos with fragments about a certain service or product, however, the problem to retrieve images and pictorial information effectively has definitely not been solved. Retrieval of pictorial information is even more difficult than retrieval of textual information (Cawkell, 1993). Automatic pictorial indexing, based on pattern recognition techniques, of pictures is in most cases still a research issue (Bordogna et al., 1990). Manual pictorial indexing in the form of assignment of content identifiers to a picture has the same limitations as assigning content identifiers to documents: they do not always match the unforeseen search terms of users.

**Update facility**

An MRS often contains a module for updating the MM objects in the MM database. Such a module must meet the need of creating and updating MM objects using MM editors, or by making use of the limited editing facilities offered by an MDBMS. If the editing of MM objects is finished, the MRS client application formulates an update statement in the database language and sends it, with the MM object, to the transaction manager that handles the transaction and performs the specified validation checks.

During update, it may be necessary to access information coding functions, for a more efficient storage of MM objects.

**Presentation Facility**

Presentation of MM objects to the user by screen, or by other means, is an essential feature of most MRS. An MRS client application sends a presentation request to the presentation facility of an MDBMS. The request includes the references to one or more MM database objects that are going to be presented. The presentation facility presents the MM object(s) via the MRS client application, according to the definitions of the related external model, to the user.

An MRS needs the support of a high resolution presentation facility, and possibilities to ease exchange of MM objects via a presentation layer. Traditional DBMSs offer only character oriented presentation mechanisms. IRSs offer, in addition, facilities to present a
document as image or as word processor document with mark-up. Compared to traditional DBMSs and IRSs, the presentation of MM information by MDBMSs becomes more complicated because of the addition of presentational aspects such as colour, location in space and time (synchronisation), loudness, etc. (ISO/IEC, 1991b). If MM objects are stored in a coded format (e.g., MPEG) it is necessary for the presentation facility to have access to a decoding function, a presenter, to present the MM object in its original form.

Exchange Facility

It is necessary to standardise the ways MM data objects are organised and exchanged for an unhampered exchange and reuse of information in the form of file transfer (ISO/IEC, 1991a) between different ISs. Data objects must be coded in a way that both systems can interpret it. This can be achieved by using a common exchange format into which the exported data and database schema are converted. The importing system converts the exchange format back to its internal representation. Exchange of MM data objects between MDBMSs is still a major problem.

In the case of the exchange of documents only a few DBMSs and IRSs support, to a limited extend, de jure document (exchange) standards, like ODA and SGML. Already more support can be found of de facto document standards like MS Word and WordPerfect. Attention should be paid to hypermedia extensions for ODA (HyperODA) and SGML (HyTime) (Newcomb et al., 1991) for MM and hypermedia purposes.

Database Administration Facilities

Database administration facilities are those facilities which support a DBA (Database Administrator) in securing, tuning and organising one or more databases as part of one or more ISs. Some of these facilities may be called by the MRS client application from within a management module.

With DBA facilities, the facilities that support transaction management, recovery (ISO/IEC, 1991a), authorisation management and access control (ISO/IEC, 1991a), thesaurus management, distribution management (ISO/IEC, 1991a), and configuration management are meant.

A problem with MDBMSs is that the logfiles 'explode' when logging transactions on MM records. Compression of MM data or omission of video data solves or reduces this problem.

2.4.6. Conclusion

In the foregoing sections the most important MDBMS facilities used by MRS client applications are discussed. The need for MDBMS facilities in a certain MM database system need to be matched by the facilities offered by MDBMSs on the market. It should be realised that this match, taking current MDBMSs, is often far from perfect. To analyse this match between facilities needed and facilities offered, a good insight into MDBMS facilities is necessary. Therefore, such MDBMS facilities should be part of the framework.
Figure 9. Summary of characteristics of MRS for M&S at the subsystem level.

To summarise, MDBMS (retrieval engine) characteristics of MRS for M&S can be described in terms of:
- the type of MDBMS, this is related to the integrational approach to handle multiple information types;
- the MDBMS facilities offered, like the DMF, search facilities, update facility, exchange facility, presentation facility, and DBA facilities.

With regard to the management of MM databases, an MDBMS based on the extended DBMS seems most appropriate. With regard to the management of MM document bases, an MDBMS based on the extended IRS approach seems most appropriate. With regard to de jure standardisation, we can note that it is important to consider support of de jure standards if reuse of information or compression of MM data is an important issue.

2.5. Summary

M&S business characteristics, MS characteristics, and retrieval engine (MDBMS) characteristics are discussed in this chapter. It is argued that these characteristics are useful for the framework for characterising MRSs for M&S in the next chapter.

The main characteristics at the business level (M&S), system level (MS), and retrieval subsystem level (retrieval engine) are summarised in figure 10.
Figure 10. Summary of framework.
Chapter 3

Multimedia Retrieval Systems for Marketing & Sales

3.1. Introduction

This chapter addresses the next subquestion of this research: what potentially viable MRSs for M&S can we distinguish on the basis of practical examples or as extrapolations of developments in M&S, multimedia systems and retrieval engines? MRS for M&S is used in the sense of an MM system or MM service with a clear retrieval component, which supports one or more M&S processes. The framework for MRSs for M&S, outlined in the previous chapter, is used to answer the subquestion and characterise MRSs for M&S, which are based on case research and state-of-the-art technological developments to be sure that these systems are potentially viable. Most of the business cases used are situated within PTT Telecom BV.

The first five systems presented are based on current cases: a Marketing Communications Archive, a Tele Sales Assistant system, an MM Business Catalogue for business sales assistance, an MM Promotion System at a trade fair, and MM Assisted Instruction for self-help training on the job. The next two systems are projections based on current technological developments: a Marketing Documentation Archive, and the Virtual Market. A last system is added to put all the parts together, and present a 'master plan' for PTT Telecom in which all the systems mentioned above work together in one imaginary M&S organisation.

Finally, some overall conclusions with regard to the viability of the MRSs, in so far possible, are discussed and the business objectives and perceived success/risk factors for the MRSs are summarised.

3.2. Symbols used in diagrams

Diagrams are used to illustrate the characterised MRSs for M&S; before elaborating the MRSs a short explanation of the symbols used in the diagrams is necessary. These diagrams are presented to show the M&S tasks and processes, performed by M&S personnel and M&S units, and which are supported by the MRSs. Further, the diagrams are used to show
the system functions of an MRSs, the information flows processed, and the databases included.

The basic symbols used are depicted in figure 11.

Figure 11. Symbols used in diagrams.

These symbols are:

- A **task** or **process** performed by an **actor**: in the present case this refers to M&S tasks and processes. The symbol used is identified by an actor name and a description of the task or process.

- A **system (sub)function** performed by a **(sub)system**: in the present case this refers mostly to MRSs and MRS functions. A system function is identified by a (sub)system name and/or a (sub)function name.

- An **information flow**: in the present case this refers to the flow of M&S information which often has an MM nature. Actors and system functions have in common that they process and exchange information. An information flow can occur between tasks/processes, between system functions, or between a task/process and a system function.

- A **database**: in the present case this refers to databases containing M&S related information. A database can be considered to be a system or subsystem with one specific function: to contain information. A database is identified by a content specific name.
• An external: in the present case an actor or system outside the defined M&S system that exchanges information with an actor performing a task/process or an IS within a defined M&S system.

A simplified diagram, with symbol descriptions in bold type, is given in figure 12.

![Diagram](image)

Figure 12. Simplified diagram with the basic symbols used.

3.3. The Marketing Communications Archive (MCA)

3.3.1. Introduction

Large organisations use huge amounts of reusable marketing communications material: photographs, videos, graphics, animations, slide shows, etc. This information is often very expensive to produce. The Marketing Communications Archive (MCA) is a centralised online archive for all marketing communications that are regularly reused by marketing organisations for advertisement, promotion and PR.
A first step towards such an MCA was made by IECT (Internal and External Communication Telecom), the PR office of PTT Telecom BV, within the context of TQM (Total Quality Management). The first ideas about the archiving system were launched in June 1991, and the first version of the archiving system was realised between August and December of that same year. No centralised archive for photographic marketing material existed within PTT Telecom BV before 1992, when the IECT photo archive became fully operational. Preparations were started to make the archive on-line accessible in the middle of 1993.

The following descriptions of the M&S business objectives and information processing tasks, MRS functions and MRS implementation aspects are based on interviews with the responsible manager within IECT, the IECT PR official, the archivist, the hired project manager, and on system documentation (IECT, 1993).

3.3.2. Business objectives

The main business objectives (O) for the IECT photo archive are related to saving costs, improving access to corporate photographs, implementing quality control, and increasing management control. (A more detailed Cost Benefit Analysis is given in chapter 5).

A decisive argument for setting up a centralised photo archive within PTT Telecom was the saving of costs by more efficient reuse of the 10,000-15,000 existing marketing photographs (O1). In the old situation it was very difficult to trace old photographic material. Photographs and slides were believed to be somewhere in a desk drawer. It was highly uncertain whether the photo material could be found or not. Working under pressure of time, it was more easy to order material for a catalogue or for an advertisement than to search for relevant old material. Another reason for not being able to reuse original material was that sometimes the old material was damaged.

The production of new photographs is very expensive, as it often means calling in an advertising agency, and hiring photographer's models. Saving costs by avoiding unnecessary production of expensive new material is expected to justify investment in the photo archive (see chapter 5).

Other cost savings are expected from the more efficient management and retrieval of the photographs (O2). In the old situation a lot of time was spent by the marketers searching for photographs.

A third cost saving point is the prevention of copyright claims after violation of copyright (O3). In the past violation of copyright or usage right sometimes occurred as a result of ignorance due to reprinting a photograph in another type of medium than agreed upon with the photographer or photographic model. Copyright claims after a violation can cost tens of thousands of guilders. Proper administration and settlement of copyrights and usage rights by a central archive administration can prevent such costly mistakes.

Another business objective of the IECT photo archive is to improve access to corporate photographic material (O4). Accessibility is important for the marketing units of PTT
Telecom that prepare marketing promotions, the advertising agencies called in by the business units, public relations officials, and external contacts like educational publishers. First, good accessibility is necessary to realise the cost savings discussed above. For example, if accessibility to the photographs does not improve in comparison to the old situation then it is highly likely that better reuse of photographs will not be within reach, and publicity personnel will probably continue ordering expensive new photographic productions. Besides, IECT also expects that increased accessibility to the photographic material will result in an increase of the total number of requests and deliveries (4500 in 1993) met by the archive facilities. This will lead to an increase in total archive and delivery costs, but will lead to a decrease in costs per delivery or stored photograph.

Second, it is assumed that better access to the corporate photographs will lead to a better and more balanced choice of advertisement photographs, and to the stimulation of advertisement by the marketing units, and free publicity in general. (With regard to the last point, it is reported by the IECT management that external contacts such as educational publishers are increasingly finding their way to the archive for materials).

IECT management aims to improve accessibility to corporate photographic material by:

• offering access to a complete and up-to-date photo database;
• guaranteeing a delivery time of maximal 4 days;
• a short selection time for relevant photographs (minutes rather than hours or days).

It is felt that accessibility is important for the acceptance of the IECT photo archive by its intended customers.

A further business objective of the IECT photo archive is to implement quality control (O5), this was not present in the old situation. Control of the quality of publicity photographs is seen as highly important because it is believed that the quality of the photographs influences the quality of marketing actions and thus indirectly, the response rate to a marketing action. In the IECT case, quality control is seen as removing low quality photographic material, and avoiding too much marketing exposure of the same photographs in the same time period. Another aspect is that it may prove useful for advertising agencies to examine and be inspired by frequently reused, popular photographs. The reuse frequency for certain photographs can be seen as a quality measure, namely a measure for the appreciation of a photograph. The reuse frequency can be monitored by noting the number of requests for a photograph.

The final business objective of the IECT photo archive is related to improving management control of costs related to the usage of photographs (O6). In the old situation little management control existed with regard to the management, and production costs of photographic material. In the new situation this has changed. It is anticipated that, in the near future, retrieval and delivery costs will be charged directly to the customers of the IECT photo archive. The charging of costs is important to make internal archiving costs visible to PTT Telecom and its organisational units, and to provide incentives for efficiency. The implementation of cost charging also fits well with the corporate policy to strive for financially responsible, self-supporting units.
Future extensions of the business objectives are being considered by IECT management, it is intended that the above-mentioned business objectives will also be applied to other types of communications. In particular, the saving of costs by better reuse (O₁) and improving accessibility (O₄) may also be applied to the archiving of company videos, animations, and selected PR documentation, like business presentations, leaflets, etc. This will eventually lead to a more complete MCA.

PITT Telecom and IECT management decided to set up a central archive assuming it is a viable way to meet the discussed business objectives: to save costs, to improve the access to corporate photographic material (a centralised photo archive solves the problem of where to look for the material), to implement quality control and to improve management control. The choice of an electronic archiving system was made because it was assumed that only by using such a system could the short search times necessary to meet the accessibility objective (O₄), and cost savings due to more efficient management and retrieval (O₂) be realised. The choice of a multimedia archive (including photographs) was made because it was assumed that this would reduce search times (O₄) and thus leads to more efficient retrieval (O₂) if photographs are displayed and can be seen by searchers. Electronification of the display of photographs has another advantage: the originals are not damaged by browsing and can be kept safely in the physical archive.

3.3.3. Information processing tasks

A number of information processing tasks are implemented during the setting up of the IECT photo archive. Figure 13 shows which tasks are performed by whom on what information within the IECT photo archive. A description of these tasks is given below.

Requests are made by customers of the IECT photo archive for the retrieval of photographic materials. Requests are made known orally, often over the phone, to the IECT archivist. During a discussion with the customer the archivist tries to interpret the request. Then, the archivist searches for matching material in the electronic archive, and produces a list of descriptions of photographs together with a reduced print of retrieved photographs. The archivist administers the search result and sends the list and print to the customer. Next, if the customer confirms the order for the photographic material, duplicates of this material are retrieved from the duplicates archive, and if no duplicates are available a reproduction order is sent to the Capi Lux photographic service. Capi Lux delivers the ordered duplicates within, at most, three days to the IECT archive. Finally, the complete order of duplicates is sent to the customer.

A further task of the archivist is to archive incoming photographs and slides, and extra duplicates. Archiving is a rather complex task. It involves:

- scanning, indexing, and storing of digital images of the material;
- storage of originals and duplicates;
- thesaurus management.
Thesaurus management is actually performed by a specialised archivist, a thesaurus manager.

![Diagram of information processing tasks within the IECT photo archive.]

Figure 13. Information processing tasks within the IECT photo archive.

A number of extensions or changes to the information processing tasks are being considered by IECT management on the basis of the business objectives discussed in the previous section. The charging of costs to customers (O6) has not yet been implemented. As yet, it has not been decided, by the IECT management, how to calculate the costs to be charged and when to set up such a charging task. To charge the customer, it is necessary to administer customer orders carefully, and to keep a financial order administration.

IECT management is considering giving regular, frequent customers the possibility to search directly in the electronic archive from their own offices, and because of this about 20 external access points are anticipated. Trained personnel from the business units may search the archive on-line, and the ordering process may be also on-line. The main argument for this is that it lowers the threshold for reuse of photographs, which is in accordance with the objectives (O4, O1) discussed in the previous section. Further it will probably reduce the need to consult the archivists of the IECT archive, and accelerates the search and selection processes (O4).

A possible new 'product' of the IECT photo archive and another way to reuse photographic material (O1) is to deliver images of photographic material. These images are used by the
marketing units producing electronic product information. Delivery of electronic images reduces the need to digitise and code information separately for every MM sales support system. A main issue to be resolved is the standardisation of video and still exchange formats.

To extrapolate from these development it is possible to envision an archive in which customers also retrieve marketing communications electronically, and print locally, if necessary. Structured tasks like charging and billing, and delivery, can also be automated. The archivist function can then be reduced to ill-structured tasks like indexing of pictures, and system maintenance tasks.

![Diagram of electronic archive](image)

**Figure 14.** Functional elements of the electronic archive.

### 3.3.4. System functionality

A description of the functions of the electronic archive is given in this section, based on the current situation. An overview is given in figure 14. The main functionality of the electronic
archive is related to database system functionality, and because of this the MM system and database system aspects are discussed in combination.

The main system functions are (see figure 14):

- **Photo capturing**: photograph capturing is performed by a photograph capturing system. Photo capturing includes input and digitisation of photographs and slides.
- **Archive update**: after photographs and slides are captured they are archived using the update facility of the electronic archive. The update facility archives images in the photo database, and stores related photo index records in a photo index database. The index terms are selected by the archivist from the thesaurus database (controlled index list) or are entered in free format.
- **Thesaurus management**: the thesaurus manager uses a thesaurus interface to manage the thesaurus database, i.e., to update the index terms in the thesaurus database. (Other database management activities are not directly supported by the electronic archive. They include the back-up of database files).
- **Search facility**: the search facility supports the archivist in searching photographs. Search terms are entered by the archivist or selected by the archivist from the thesaurus database. Searches are performed on the photo index database. Searches can be stored in the search history and can be re-executed. The result set of a search with references to photographs in the photo database is presented to the archivist.
- **Presentation facility**: the presentation facility retrieves images from the photo database; the result set with references to the images, produced by the search facility, is used for this purpose. The presentation facility delivers prints of images (prints to screen or prints to paper) to the archivist.

On the basis of the possible extensions of the information processing tasks, discussed in the previous section, we can anticipate several extensions of system functionality:

- direct access to photo searching and photo presentation functionality by authorised customers of the IECT archive;
- export functionality for the electronic delivery of images to customers;
- charging functionality for charging and billing of delivered photographs and slides;
- extended input functionality, update functionality, search functionality and presentation functionality for digital video, audio and animation;

Extended search functionality like full text search mechanisms may prove useful for retrieving PR documentation and leaflets. Hyperlinks from the photograph in the digital photo archive to the leaflet where it is used may also be very useful.

### 3.3.5. Implementation aspects

The MRS implementation aspects for the IECT photo archive are discussed in this section. First, general MRS implementation aspects, then MDBMS implementation aspects are discussed.
The electronic archive is a simple MRS. A caption camera is used to capture photographic material. The images are stored in an analogue format on duplicated video disks (one as a backup). A video disk may contain up to 60,000 of such images. Currently, a PC controls the video disk, and is used for data-entry of descriptions and searching through these descriptions which are linked to the stored, analogue images. A TV monitor is used as the output medium to display the analogue images. A thermal transfer printer is used to print the photographs (9 photographs to a page) for selection purposes, and a normal printer is used to print alpha-numeric descriptions. The system software, alpha-numeric descriptions and search requests are stored on hard disk, and a back up is made via an Ethernet-LAN.

No really integrated database management facility (see chapter 2) is used for the management of the photo database and the photo index database. The photo database contains now about 6000 images of photographs and slides. (Only those photographs are stored which are likely to be reused). The photo index database contains the same number of records with alpha-numeric descriptions of these images.

Only the storage and presentation control are integrated in the PC software. The retrieval engine used is also fairly simple. The DBMS Picbase offers the update facility, search facility, presentation facility and the thesaurus interface used to lubricate the stills. The version of Picbase used only allows for a two levelled rubrication: a broader term and a narrower term. Examples of rubrication terms for the IECT photo archive are:

activity - sport
objects - building
objects - telecommunication infrastructure

Other essential attributes of the entity type photograph are a unique reference to the physical archive, and a unique reference to the laser disk, photo production data, background, direction of view, colour, type of object, activity, atmospheric description.
An example of a unique reference to the physical archive is:

P-130-01254 (P = slide, 130 = size 100x130 mm, 01254 = serial number 1254)

New versions of Picbase will support more thesaurus functions. The Picbase thesaurus does not support any international thesaurus standards at the moment.
No motivation is given for the choice of Picbase and its thesaurus facility. Other search facilities and other retrieval software are simply not considered.

The intentions of IECT to improve the accessibility of the photo archive by offering marketers direct access to the photo archive system brought to light limitations of the current implementation:
- Analogue images need to be converted into a digital format to communicate them using a digital system and digital network. To eliminate this bottleneck, a conversion effort has been started to store the stills of photographs and slides in a compressed
digital format, JPEG or FIF (a fractal interchange format), on a digital medium. The advantage of FIF over JPEG is that FIF results in higher compression ratios (and thus more efficient transmission and storage). ISDN is the preferred transmission medium for remote access.

- The current implementation on a DOS-PC is single-user, and needs to be prepared for multi-user access. To avoid the limitations of DOS, one can imagine a migration towards Windows NT or a UNIX environment. If this happens, it will be necessary to choose a new retrieval engine instead of Picbase.

- The implementation of the thesaurus search facility is considered by IECT to be too complex for the archive customers. Adequate use of this search facility requires archivists knowledge of the way the stills are rubricated, and this is a bottleneck for untrained customers. Straight forward QBE (Query By Example) screens could be offered to overcome this problem, requiring the presence of a query language, and less complex (= confusing) screen lay-outs. The next version of Picbase will offer a possibility for searching on attributes of database objects, this will probably suffice to support QBE.

- The response times for searching a selection of objects in the database are too long (many minutes), which is not seen as acceptable for customers. The response time must be shortened to seconds. This may be done by indexation of the rubrications and database fields.

If the IECT photo archive is extended towards a more complete MCA than an MDBMS should be considered, e.g., the ORACLE DBMS, this is a company standard within PTT Telecom.

3.3.6. Discussion

An MCA like the IECT photo archive is clearly technically feasible, and seems viable if the acceptance of the system by the IECT management and users, and the growing use of the IECT archive by marketing departments and other customers is taken into account.

A number of strengths and weaknesses have been reported by the IECT respondents or can be observed. First of all, only a very rough cost benefit analysis was performed beforehand. The business value added of the IECT photo archive was analysed predominantly in qualitative terms and very rough quantitative terms. Nevertheless, this analysis was convincing enough for the PTT Telecom and IECT management.

Second, MM and retrieval are reported to have a clear value added. The observed value added of MM is mainly that photographs are better and faster selected when they are presented together with their retrieved descriptions. The observed value added of retrieval is related to reducing search times.

Third, the photo archive is seen as a first step towards a full-grown MCA. This growth path was only defined by the IECT management after the first version of the electronic archive was delivered. This makes conversions necessary that could otherwise have been avoided.
Other weaknesses reported by the IECT respondents are that there was little IT and automation knowledge available within IECT when the IECT photo project started, too limited requirement analysis and system specification was carried out with an insufficient review of implementation alternatives, for example, with regard to the choice of the retrieval engine.

3.4. The Tele Sales Assistant (TSA) system

3.4.1. Introduction

A telephone sales assistant is someone who can be called for information or help about products and services; in their turn assistants need assistance with the marketing and sales activities, from a Sales Support System, called Tele Sales Assistant (TSA) system by the business unit Consumer Market of PTT Telecom. In general, a TSA system can be described as follows: a TSA system is a front-office sales assistance system which offers support for order intake and complaint handling, that is integrated seamlessly with back office order handling and product management processes.

The TSA project started in September 1991 with a preparatory study, from January 1992 to the Summer of 1993 several prototypes were developed to demonstrate TSA system functionality to the Consumer Market management and to further elucidate specifications. A requirement and specification study was conducted during the same period. In November 1993 the TSA system was implemented at two test sites. March 1994 saw the start of a pilot phase in which a more stable TSA computing environment was set up, one that was over the teething troubles. The TSA system was introduced nation wide in the Autumn of 1994. Total development and implementation costs, including training, were about 1 million guilders (HFL). Operational costs are estimated at about HFL. 250,000 a year. Further, it has been estimated by the TSA project team that the implementation costs will be recovered in approximately 1 year from nation wide implementation.

The following descriptions of the M&S business objectives and information processing tasks, MRS functions and MRS implementation aspects are based on several interviews with the manager responsible for the TSA project, several hired in developers, and TSA documentation (Peeters, 1993), plus incidental participation.

3.4.2. Business objectives

The business objectives (O) of the TSA project are to improve the quality of service to consumers, to increase the productivity of tele(phone) sales employees, to reduce training costs, and to improve internal information processing.

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251 US Dollar = 1.76 HFL (September 2, 1994).
Consumer Market management believes that improving the quality of service to consumers (O₁) will lead to better customer relations and (indirectly) to more turnover. Improving the quality of service is translated into:

- improving the telephone contacts by better informing customers;
- improving the accuracy with which questions are answered;
- improved dealing with consumer complaints;
- shortening waiting times for consumers.

The objective of the TSA project is to increase the productivity of telesales employees by an improved return on telephone contacts with consumers (O₂). It is believed that an increase in productivity is possible by:

- dealing with more callers during a time period;
- unhampered order intake;
- improvements in informativeness and ability to give convincing selling arguments.

An increase in productivity is influenced largely by factors other than the introduction of a TSA system, in particular by marketing actions to stimulate customers to contact telesales centres.

Another objective is to improve the knowledge level of telesales employees (O₃). It is assumed that telesales employees with a sound knowledge of products and services are more productive. In the old situation, the training of new telesales employees formed a serious bottleneck, in part due to a high turn over of telesales employees and a limited training capacity.

Discussions with TSA project team members made clear that some extensions to the business objectives can be expected if the TSA system proves successful. The most likely extensions are applying the business objectives to other types of sales personnel, namely shop employees in the consumer shops, and personal sales personnel, business shop employees and telesales personnel for the business market. It seems very likely that the business function of the SSS (Sales Support System) will be extended, sooner or later, by including support of shop sales. The business units Consumer Market and Business Market both run telecommunication shops, called respectively, Primafoons and Business centres. For shops, the business objectives are increasing sales volume, improving the quality of service to customers, more efficient order intake and improved promotion.

An interactive training module as part of the TSA system seemed necessary when thinking about a solution for the training of sales employee (O₃). A side effect of such a training module is that training on the job becomes possible and that external training costs can be reduced. Nevertheless, the most important expected result is having telesales personnel trained more quickly.

With regard to the first two objectives (O₁ en O₂) it is believed that improved sales support in the form of a TSA system will contribute to meeting these objectives by removing
bottlenecks found in the old situation. One of these bottlenecks is formed by the limitations the sales support used currently: a paper telesales catalogue. The paper telesales catalogue is insufficient to support telesales employees effectively for several reasons. First, topicality of the paper catalogue is not as high as needed. Second, the catalogue is not complete (e.g., news about marketing actions is absent). Third, searching through paper manuals is slow. To remove these bottleneck the choice was made for an electronic TSA system, which
• is complete and topical;
• gives fast results, a few keystrokes calls up the information required.
(It is observed at the TSA system test-sites that searching for information in the TSA system is indeed much faster than searching for the same information in the paper documentation). A TSA system must support order entry and reporting complaints, which can be processed by other employees in the Consumer Market unit, to facilitate unhampered order intake and handling of customer complaints.

A multimedia system was chosen as it was assumed that showing pictures of products has important advantages. An important (assumed) advantage is that communication about products between customers and telesales employees is eased (O₁) when the telesales employees are provided with the same catalogue information as the consumer ("I want the phone with the red buttons, not the one with the curly string"). It is also assumed that when the presentation of product information is improved by showing product pictures, product specifications become more understandable for telesales employees. Next, it is assumed that improved retrieval and presentation of assortment related information to telesales employees results in an improvement in answering customer questions and improvements in informing customers about products and services (O₁).

3.4.3. Information processing tasks

Based on the business objectives and choices discussed in the previous section a number of information processing tasks were selected to be supported by the TSA system. Figure 15 shows what tasks are performed by the employees involved on what information. A description of the tasks of involved employees is given below.

There are about 500 telesales employees spread over 32 regional call centres. They cope with the requests of domestic consumers and increasingly of business people. The types of requests dealt with include request for information about the cost of a service, handling a problem with a telephone connection, or placing an order. The telesales employee takes a note of the customer request and tries to give immediate feedback. If the telesales employee does not know the answer they can use the TSA system. The TSA system gives up to date information about products (characteristics, selling arguments, current prices, special offers, etc.), newsletters, and current marketing actions.
Orders are entered in an order entry system and problems are reported. The handling of problems and orders is outside the scope of the TSA system.
As can be seen in figure 15, the TSA system is a valuable information source for other employees, like marketers, sales managers, and product managers. An editor updates the contents of the TSA system, and a teacher the contents of the training module when necessary.

![Diagram of TSA system](image)

Figure 15. TSA system in relation to the tasks of a telesales employee.

If a decision is made to extend the business objectives to other sales outlets it is necessary to consider to what degree other information processing tasks need to be supported by the SSS and to what extent other information items need to be included. (If very different tasks and information items are involved it is more economical to develop completely separate sales support systems for the different outlets).

In the case of support for shop employees some differences can be noted. Shop employees are under more variable pressure of time than telesales employees, and they already work with a number of information systems, like an order entry system. An SSS needs to be neatly integrated, as having many different terminals on the counter (for every IS one) is not workable for shop personnel. An important difference from telesales employees is the physical presence of customers, presentation of SSS information to the customer can be an additional task.

In case of sales support of personal sales some other important differences can be found. Personal sales differs from other types of sales in that customer relation management is stressed, personal sales staff are more mobile, and personal sales staff often combine customer care with back office activities like developing sales plans. The SSS for personal
sales staff therefore needs to be integrated seamlessly with the software applications they use, like a presentation tool, word processor, an order entry system, and a customer IS.

In general, (tele)sales personnel can not be seen as high level IT users, who can be directly confronted with the more complex retrieval facilities. This leads us to another basic requirement for any SSS offered: it should be easy to use by relatively untrained IT users.

3.4.4. System functionality

A description of the functions of the TSA system is given in this section. An overview is given in figure 16. General TSA system functionality is discussed first followed by a discussion of TSA database system\(^{26}\) functionality.

The main system functions are:

- **Order entry**: the TSA user interface offers functionality for order entry to telesales employees. Entered orders are sent on to an order system.
- **Problem entry**: the TSA user interface offers functionality for problem entry to telesales employees. Entered problems are sent on to a complaint system, a strategic corporate resource.
- **Assortment retrieval**: assortment retrieval is a main function of the TSA system. Telesales employees, marketers and product managers use this functionality. The TSA user interface sends retrieval request to the TSA database system, which returns requested assortment information for presentation.
- **Product news retrieval**: telesales employees particularly use the product news retrieval functionality. The telesales employee makes a selection, which is translated into a request to the database system. The database system returns one or more product news leaflets, which are presented to the user by the TSA user interface.
- **Telesales news retrieval**: telesales employees particularly use the telesales news retrieval functionality. The telesales employee makes a selection, which is translated into a request to the database system. The database system returns one or more telesales news pages, which are presented to the user by the TSA user interface.
- **Training**: a training function is offered to telesales employees (see section 3.7. for more details). The answers to questions given by telesales employees are registered by the training function in the TSA database system. Training information is retrieved by the training function from the TSA database system.

The TSA system offers a production environment for the:

- **Production of assortment information**: the TSA editors prepares information from a corporate assortment IS to be updated to the TSA database system.
- **Production of news information**: the TSA editor is supported by functionalities to digitise news information and to edit information in the product news and telesales news databases.

\(^{26}\)Database system = retrieval engine(s) + database(s)
• **Training editing:** teachers are supported in authoring courseware and updating the training databases in the TSA database system.

The database system functionality is separated into two environments: the production databases environment on the right and the retrieval databases environment on the left. The reasons for this separation are discussed in the next section. The main database system functions are (see figure 17):

- **Updating:** the update facility offers updating functionality to the production environment for the updating of telesales news, product news, assortment and training production databases.
- **Data exchanging:** the exchange facility exchanges database information from the production databases to the retrieval databases. The database administrator initiates data exchange by submitting an exchange request to the exchange facility of the TSA database system.
- **Searching:** the search facility offers the TSA (user) interface search functionality. The TSA interface sends queries. The search facility returns result sets.
- **Presentation:** the presentation facility accepts presentation requests (including references in a result set) from the TSA interface and returns information objects from the telesales news, product news, assortment and training databases.
Taking as a basis the extensions considered for the information processing tasks, discussed in the previous section, several extensions of system functionality can be anticipated:

- direct access to the TSA system by customer, limited to the TSA (user) interface;
- commercial presentation functionality, to confront customers with attractive promotions.

Direct access by customers puts heavy requirements on the ease of use for the user interface of the TSA system.

### 3.4.5. Implementation aspects

MRS implementation aspects are discussed in this section on the basis of the subsystems shown in figure 16, followed by a discussion of MDBMS implementation aspects on the basis of the database system functionality shown in figure 17.

The decision was made to implement the TSA system in an MS-Windows/PC environment, because the MS-Windows/PC environment is a standard part of T-workplace, and T-workplace is the standard MS-Windows/PC based equipment for a PTT Telecom workplace. The TSA interface and production environment were programmed in Visual Basic.

Currently, a major technical limitation is related to on-line transmission: offering on-line pictorial retrieval by a nation wide Wide Area Network would lead to high telecommunication costs. Therefore a cyclical downloading procedure was set up to update the local file servers of the 32 telesales centres (one server per centre). The TSA system
software and databases are stored on these local file servers, a 486-PC, accessed by a 10 Mbit/s Ethernet. The TSA databases are downloaded by the business network (alternative transmission media for remote update are N-ISDN, PSTN or the business network Themis). A more severe bottleneck at present is that downloading of large volumes of video data via the Wide Area Network is not affordable. It will take some years before the price/performance ratio has improved enough too make downloading video files affordable. It will take even longer before on-line video retrieval by a WAN will be affordable.

The production environment consists of a digital camera to photograph products and a scanner for input of pictures in GIF format, a download interface to the PTT Telecom assortment IS, and an authoring interface to edit the content of the TSA databases. The GIF format was chosen because it is a widespread graphics format and offers an acceptable compression ratio. (Better than TIFF for example). The authoring interface was programmed in Visual Basic and offers the functionality defined in the previous section.

The TSA interface consists of a PC with VGA monitor placed on the desks of the telesales employees, a keyboard and mouse for controlling the application, and Visual Basic software for accessing the local databases in telephone centres.

The information types used are:

- graphics for the human interface;
- GIF pictures of products;
- text to describe products, to give news about marketing actions and products, and to ask training questions;
- and instruction videos (AVI) in the training module.

TSA system GIF pictures are presented to the user in two sizes: small and full screen. The full screen picture of a product appears if the user clicks on the small picture which is presented together with product information. The full screen picture shows more visual product details. Instruction videos are not yet included in the operational TSA system, only in a prototype, because they require too much hard disk and network capacity. An option is to use optical disks for training material including full motion full screen video. This would relieve the business networks and the local file server, however, the disadvantage is that changes in the TSA system software are not so easily updated to the training system. For every training database update, new circulations of optical disks need to be produced and distributed.

The TSA interface offers retrieval by:

- a hierarchical menu structure, which can be rather laborious; especially when the database is growing, this limitation of menu structures becomes a time consuming bottleneck;
- graphical browsing through a list of product categories and names;
- by offering the possibility to search on key words.

Key word search functionality is presented in the form of a fill in the blanks screen (Query By Example - QBE), in which a sales employees fills in, for example, a product name field and/or a product colour field.
The inclusion of hyperlinking is considered for the TSA interface, to permit direct jumping to related information by clicking on hot words to trace likely associations. If speech recognition software improves it may be possible to include query by speech in the TSA interface: one can imagine the telesales employee repeating the product name the customer is interested in. Speech input is much faster than input by typing but voice input may disturb TSA interface interactions of other employees.

Some TSA system extensions or modifications are discussed in the previous sections. Extending the TSA system towards a SSS for shop personnel would not really require different types of media, however, extending towards a SSS for personal sales does lead to transmission media extensions, as personal sales staff is mobile. This would require retrieval possibilities using a notebook with a communication interface (for ISDN) to access topical data. Spreading the SSS data by CD-ROM or CD-i is an alternative, although this still requires an on-line connection possibility to access information that has a limited life span, such as price information, marketing actions and product news. A network connection is also needed for ordering. The high cost of introducing notebooks with CD-ROM and/or ISDN connections for all personal sales staff is a drawback.

The TSA database system consists of an Access DBMS from Microsoft as the retrieval engine, Access database files, and GIF files in directories. In total, the size of the TSA databases is approximately 100 MB (excluding video files). The MS-Windows DBMS Access, a conventional DBMS offering all basic DBMS facilities (see chapter 2), is only used for management of the structured data. Ill structured data (i.e., the GIF files) is retrieved by external references to their path and file names on hard disk. Hence, we can conclude that the extended DBMS approach is followed (see chapter 2). Hidden from the user, the search facility uses a standard DBMS search facility (SQL based). The Access presentation facility is used to present retrieved database objects to the TSA interface. The update facility and exchange facility are used to update the TSA databases from the production environment. This includes assortment updates from Oracle databases (the Assortment IS is implemented by the Oracle DBMS).

An alternative retrieval engine, which takes into account the possible growth path of the TSA system towards a more inclusive SSS, would be a real MDBMS. The advantage would be that the integrity of references to ill structured data objects could be better controlled. A disadvantage is that the retrieval performance would slow down, but this can be compensated for by faster PC hardware.

3.4.6. Discussion

The TSA system is feasible and seems viable if we consider the enthusiastic responses of telesales employees and telesales managers, and the strong management commitment. We should, however, be cautious about enthusiastic responses: they can disappear as fast as they come.
A number of strengths and weaknesses were mentioned in discussions with the TSA project team. Measuring the value added of the TSA system is seen as important, evaluative measurements are scheduled although it is hard to isolate the TSA effects on quality of service to customers and productivity because there are many other influencing factors. The assumed value added of MR of the TSA system is based on a better recognition and understanding of products by seeing pictures, and shorter retrieval times in comparison to retrieval using paper catalogues.

The strong management commitment is seen as a very positive aspect, that is extremely important for initiating changes in such a large organisation as PTT Telecom. High involvement of the sales people, who are going to use the TSA system, is seen as a success factor of the TSA project. It is believed that convincing the sales staff of the value added of the TSA system, in terms of easy access to topical and complete information in support of their sales conversations, is a crucial success factor for the TSA system. Changing (re-engineering) the business processes in combination with the introduction of the TSA system is seen as a very difficult job. Not so much because of the complexity of the tasks, but because of the social and political hurdles that have to be overcome. Other difficulties mentioned are lack of familiarity with MT (MM technology) applications within PTT Telecom, and integration with the corporate IT infrastructures.

3.5. The Multimedia Business Catalogue (MBC)

3.5.1. Introduction

M&S business outlets work with catalogues to present assortment information to their business customers, but also to support their sales staff. The quality of paper catalogues is often too low, in terms of topicality, completeness, media richness, searchability etc. Business sales assistance by MM Business Catalogues (MBCs) may benefit from the improved catalogue quality. An MBC is a multimedia system which presents the complete business assortment vividly, and offers transparent support of all assortment related processes to business sales staff and large business accounts. An MBC may be used by the large business accounts, because they order products and services covering the complete portfolio of an M&S firm. It may be affordable to offer a stripped MBC to smaller business accounts. The IBM direct catalogue and the Philips audio-visual products catalogues offered to business relations are examples of commercial MBCs.

A lack of topicality, completeness, media richness and searchability can be seen in the case of the General Specification (GS) catalogue of PTT Telecom. This paper GS catalogue supports the PTT Telecom Business Market sales staff. An analysis was made that suggested that an MBC would be a solution to these failings (Hoogeveen, 1993c). In a feasibility study it was also concluded that an MBC would meet the requirements for sales support of personal sales (De Ruyter, 1993). A first prototype of the MBC was developed.
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by PTT Research during the second half of 1993. The development costs of this prototype were only about HFL 30,000.-.

The following descriptions of the M&S business objectives and information processing tasks, MRS functions and MRS implementation aspects are based on interviews with sales personnel, and the results of the PTT Research PROMISE project.

3.5.2. Business objectives

The main business objectives (O) for the MBC are to improve the quality of the catalogue as a sales support tool, and to streamline internal information provision.

It is assumed that improved sales support will contribute to an improved customer contact and increased sales volume. Therefore, improving the quality of a catalogue as a sales support tool is seen as an important objective (O₁).

An analysis of the old GS catalogue (Hoogeveen, 1993c) shows that the topicality of the paper catalogue declines from 90% at the moment of distribution to 63% after 6 months when it is replaced by an update. Topicality is operationalised as the percentage of assortment descriptions needing update. Shortening product life cycles and shorter time to market puts even more pressure on the topicality of assortment information. The completeness of the catalogue is about 58%, meaning that 42 of every 100 assortment descriptions has one or more empty fields, like missing contact persons, selling arguments, service desk telephone number, etc. Other problems are related to the ease of handling a paper catalogue, accessibility and its presentation quality. It is believed that a media rich MBC helps to convey the essential assortment information to sales personnel who suffer from information overload. The same is believed to be true for their customers.

A second related objective is improving internal information provision by canalising sales information (O₂). A current problem is that business sales staff is overloaded with assortment information, product and service handbooks and specifications from diverse marketing departments. If assortment information is canalised through one information channel, the MBC, this would reduce the load of unstructured, difficult to search and retrieve, paper information in sales offices.

The following extensions of business objectives for the MBC are possible. One can imagine improving customer relations by offering business accounts direct access to the MBC from the customer's offices. It can give suppliers a competitive advantage to be a de facto preferred supplier. Offering direct access to an MBC will lead to a rise in system (production) costs, which need to be recovered by extra profits or efficiency gains by cutting sales staff and reducing order administration.

A choice might be made for an electronic catalogue as this offers possibilities to improve the quality of the catalogue, particularly topicality by continuous updates, completeness by adding all relevant information without being restricted to two pages per assortment item,
and searchability. A choice might be made for a multimedia catalogue because this offers the possibility to replace current illustrated catalogues and related material, and for to improve of the presentation value as a tool to support interactions with business customers.

3.5.3. Information processing tasks

As can be seen in figure 18 assortment information provision involves diverse processes and M&S people. Product managers, responsible for the management of about 300 products and services, monitor the assortment information in the MBC and related sales volume figures. Sales volume figures by product, produced by Order IS, is the feed-back the product manager triggers to take actions, like developing new products or services or initiating more sales promotion.

![Diagram showing information processing tasks related to business sales support.](image)

Product related information that needs to be included is edited by a catalogue editor responsible for catalogue management. The catalogue editor performs updates and extensions, using input from the marketing archive in the form of pictures, animations and videos.

The marketing department responsible for promotions, use the MBC as a source for developing marketing actions. These marketing actions are directed at business customers, for example, in the form of a mailing, and are fed into the MBC by the catalogue editor.
The target group of users are the over 400 personal sales people in the business outlets. Casual users are other types of business sales people, a heterogeneous group including account managers, technical sales people and telesales people. Personal sales people use the MBC to prepare themselves for pro-active or re-active sales conversations. They retrieve actual assortment information, access manuals for technical background information and for installation, and read marketing news (promotions) to present special offers to their customer. Technical background information is particularly of interest to technical sales people. A very important issue is that the personal sales people and account managers can use the MBC as a presentation tool to support sales conversations with business customers. Therefore the MBC includes customer-centred promotion videos.

Orders and customer information are entered by the business sales people. If direct access to an MBC is offered to business customers, orders and customer information can be entered directly by the business customers themselves.

3.5.4. System functionality

A description of the functions of the MBC is given in this section. First, general MBC functionality (see figure 19) is discussed followed by a detailed discussion of MBC database system functionality (see figure 20).

The main MBC functions are:

- **Order entry**: the MBC user interface functionality for order entry by business sales people. Entered orders are sent on to an order system.
- **Problem entry**: the MBC user interface offers functionality for problem entry by business sales people. Entered problems are sent on to a complaint handling system, a strategic corporate resource.
- **Account file management**: the MBC user interface includes functionality for entering data about accounts in a file and editing these account files. Business salesmen and account managers can use this functionality.
- **Assortment retrieval**: assortment retrieval is a main function of the MBC system. Business sales people, and business customers, product managers and marketers can use this functionality. The MBC user interface sends retrieval request to the TSA database system, which returns the requested assortment information to be presented.
- **Solution composition**: the PTT Telecom assortment contains many service elements that can be part of a business solution for a customer problem. The MBC interface can offer functionality for the composition of service elements into feasible and profitable solutions. The solution module can check the solution and present it in an attractive way. Solutions can be stored in the MBC database system and be retrieved from this database system. Standard solutions, prepared centrally, can also be retrieved.
- **Presentation**: the MBC interface offers presentation functionality to support personal sales people and account managers in their business presentations. The presentation functionality can also be accessed by interested customers to look up ready made
presentations. To do this, the MBC interface retrieves ready to use and self-explaining presentations from the MBC database system. The use of presentations is registered in the database system as a performance measure, this and other performance measures, are of interest for marketers. Personal sales people and account managers can also use the presentation function to create, store and retrieve their own presentations.

- **Editing**: the catalogue editing environment offers functionality for editing the MBC by a catalogue editor. This includes the creation, updating and removal of catalogue information and MBC software.

![Diagram of MBC system](image)

**Figure 19. Functional elements of the MBC.**

The main database system functions are:

- **Updating**: the update facility offers updating functionality to the production environment for the updating of presentations, and assortment information. Further, it
The main database system functions are:

- **Updating**: the update facility offers updating functionality to the production environment for the updating of presentations, and assortment information. Further, it offers update functionality to the MBC interface for the updating of solutions and customer profiles based on their choices and information requests.

- **Data exchange**: the exchange facility exports relevant customer information from the customer interest profile database to a corporate customer IS.

- **Searching**: the search facility offers the MBC (user) interface search functionality. The MBC interface sends queries. The search facility returns result sets of customer interest profiles, business presentations, assortment files and solutions from their respective databases.

- **Presentation**: the presentation facility accepts presentation requests (including references in a result set) from the MBC interface and returns information objects from customer interest profiles, business presentations, assortment and solutions databases.

Figure 20. Functional elements of the MBC database system.
3.5.5. Implementation aspects

The MRS implementation aspects for the MBC are discussed in this section. First, general MRS implementation aspects are discussed, then MDBMS implementation aspects.

The MBC interface runs on an MPC (Multimedia PC) and consists of MBC access software. The MBC interface presents all information types: animations to explain, for example, the way a Greenpoint wireless telephone works, video for commercials and to show the use of services, music and speech in support of video and animations, texts to describe the attributes of products and services, and structured data for prices, customer information and ordering. Speech is also used to present texts, for example, when personal sales staff is on the road to a customer. The more the MBC is used by customers the more the marketing value becomes important. In this light one can justify improving the reality value of animations by including 3D views of products.

The prototype of the MBC interface is developed using the authoring tool Multimedia ToolBook 1.5 of Asymetrix Corporation which runs in the MS-Windows 3.1 environment and supports Dynamic Data Exchange (DDE) and Dynamic Link Libraries (DLL). Multimedia ToolBook is used for three reasons: it supports presentation of multimedia information, offers an easy to use development environment and Toolbook development experience was available. The choice of the MS-Windows environment is made because this environment is in accordance with the PTT Telecom workplace standard and the MPC standard. In the MBC prototype the Soundblaster 16 ASP audio card of Creative Labs is used for playing audio. The output media used are built-in loudspeakers for good quality sound. Video is displayed in video for windows (AVI) format.

The interface of an operational MBC can be developed with an authoring tool like we used for the prototype (i.e., Multimedia ToolBook). If more programming flexibility is needed it is possible to use programming languages like Visual Basic and C++. The operational MBC interface platform is extended, in comparison with the prototype, with a LAN connection for access of remote databases, an ISDN connection, video cards for playing MPEG1 quality video, and a CD-ROM player.

Portable PCs can be used by personal sales people to download parts of the MBC database by a LAN or ISDN basic rate connection, and present MBC information to customers at their own offices. When a presentation for larger audiences needs to be given a connection to a transview for overhead projection or RGB projector is needed. One can imagine that spoken commands or a remote control are used to control the MBC interface during presentations.

If a customer is provided with MBC access one can imagine several scenarios. First, they can be provided with a limited MBC on CD-ROM and an ISDN basic rate connection for

\[27\] The choice of ISDN is based on the assumption that business organisations will upgrade their telephone connections towards ISDN. If this assumption is false we should consider normal telephone connections in stead of ISDN connections.
tele-ordering, and entering customer complaints and desires. The advantage of CD-ROM is that it is a cheap distribution medium for large circulations. Second, the use of an ISDN connection is a useful alternative to download updates of the MBC database to hard disk.

The Catalogue editing environment consists of tools for the production of content data and an authoring interface. As yet, no authoring interface has been created in the MBC prototype. ToolBook is used for the authoring. Further, the Soundblaster 16 ASP audio card of Creative Labs is used to capture, digitise and play audio, and the DVA-400 overlay board and Mediaspace board of Videologic are used to capture and compress video. A scanner is used to digitise and code product pictures in TIFF format. The editing platform consists of a Pentium PC.

In an operational system, the catalogue editing environment needs to include a heavy PC equipped additionally (in comparison with the prototype) with:

- input media, digitisation cards and coding cards for MPEG1 video and audio;
- a caption camera for high quality picture input;
- a CD Writer to write CD-Recordables in CD-ROM format;
- a DCC or DAT tape recorder to record the content of a CD-ROM and send it to a CD printing office for making copies;
- professional editing software to edit audio, video, pictures, animations and text;
- an authoring interface to update the MBC database system.

The representation of video and audio can be improved by supporting successors of MPEG1, like MPEG2 and later MPEG4. Improved compression ratios obtained by these successors will increase storage and transmission efficiency, and makes it more cost-effective to update the complete MBC database remotely, and later on to offer on-line access to the complete database (without remote updates). An advantage is that an improved quality of video presentation may increase the marketing value of the MBC, i.e., attractiveness, attention value, level of impact of messages, etc.

The MBC database system consists of a retrieval engine and MM databases. In the MBC prototype Superbase 2.0 of Software Publishing Corporation is used as the retrieval engine to search structured data. An operational version of the MBC can use ORACLE version 7, which complies to the PTT Telecom database standard and which supports storage of BLOBs. So, in fact, the extended DBMS approach is followed.

The most distinguishing retrieval facilities of the MBC prototype, which are now developed in the ToolBook application but could be better supported by the retrieval engine, are the use of hypermedia and IRS retrieval mechanisms in addition to standard DBMS retrieval mechanisms. The hypermedia facilities used are hyperlinking to trace references from a specification page to an associated marketing video, and graphical browsing for backtracking and selecting business presentation elements, etc. The IRS retrieval facilities are set manipulation, full text indexing and full text retrieval to search through the GS pages (documents) without knowing key words beforehand.
A description of an implementation scenario for an operational MBC database system follows. The operational MBC database system is stored on powerful local servers connected to MM LANs (>100 Mbit/s). The servers are updated cyclically from the central catalogue system using basic rate ISDN for small size files and CD-ROM for stable video and audio files. The bandwidth of the public connection will be gradually expanded with the expansion of the catalogue database over the years. The catalogue database will start at a size of about 600 MB (with an average of 2 MB per product/service and 300 products and services) and grows to many GBs when longer promotion videos are included later.

The MM retrieval engine used supports storage of GS pages in an MM document format to improve the re-usability of the GS pages. Ineffective exchange of documents between incompatible document processing systems can thus be avoided. One can imagine the support of the file formats of MM successors of popular word processors like WordPerfect and MS Word. If ISO MM document standards HyTime and HyperODA are broadly accepted by the market we can imagine support of these standards by the retrieval engine.

The retrieval engine further supports some other facilities.

- It supports the automatic MPEG and pictorial coding and decoding of objects. Audio, video and pictorial objects are coded automatically when they are stored in the databases and are decoded automatically by the presentation facility of the retrieval engine when they need to be presented by the MBC interface.
- A profile facility is needed to send GS pages to business customers, personal sales managers or product managers according to their predefined profiles.
- A ranking mechanism is used in addition to a full text search mechanism to support sales people in searching relevant information.

The developments of automatic pictorial indexing should earn special attention to retrieve video fragments and pictures effectively for presentation composition. This would offset the disadvantage of manual indexing which is time consuming, and thus expensive.

3.5.6. Discussion

On the basis of the prototype and known examples we can conclude that MBCs are technically feasible. The most important business opportunity for the MBC seems to be reduction in sales outlet costs if an MBC is used to support tele-ordering by customers. Tele-ordering results in reduction in personal sales or telesales costs for the supplier and possible price reductions for the customer. The assumed value added of MR is based on the idea that an improved presentation of products and services is motivating for customers, and efficient and effective for retrieval by pictures, associative references and key word searches. The MBC offers an easy to handle retrieval interface to browse or search through the catalogue database including interactive manuals, marketing actions and promotion videos.

A strength of the MBC system, which should be offered as an integral part of an SSS, is that it offers all assortment related information via one channel to business sales people, and other types of actors. This will lighten the burden of being overloaded with unstructured paper information.
One success factor is the degree to which the MBC system complies with the business standards for workplace automation, and eases the use of the catalogue as a portable system for business presentation purposes. The MM presentation has the advantage that it may result in improved information impact and retention and higher customer satisfaction, i.e., more fun. It is believed that this will result in stronger customer relations.

One problem with the MBC system, so far, is that the infrastructure is not yet in place for MBCs: too few of the installed base of PCs have an MM capacity at present. This problem will cease to exist over time, when MPCs become part of the standard workplace infrastructure.

A small drawback is that MM catalogue editing is rather complex in comparison to the current text editing function, therefore, a specially trained and skilled editor is necessary. Another drawback is that the system management and operational system costs for sales support will rise, due to the introduction of an MBC, and because of the use of vast amounts of MM data.

One problem with the MBC project is that, although target groups responded positively to the MBC prototype, it is hard too give forecasts for effectiveness gains in the personal selling process. Another problem to be considered is that there is little MM experience at present within the information management, system management and automation departments. A small pilot project can be used to tackle these problems, give answers to questions with regard to system effectiveness, and result in further practical MM experience for the organisation.

3.6. The Multimedia Promotion System (MPS)

3.6.1. Introduction

Entertainment is in the lift on fairs and exhibitions, and therefore the media richness of presentations or other fair communication means are upgraded, in competition for the attention of visitors. MPSs are an exponent of this development. MPSs are particularly useful when the real product or service can not be demonstrated at a trade fair. MPSs can be found at trade fairs in the form of MM infotainment machines with service simulation capabilities that can give a feel of the product or service and have a high relative marketing impact. *Multimedia Promotion Systems are interactive audio-visual marketing systems that introduce services to individual visitors or audiences to motivate them to purchase these services.* MPSs may assist potential customers and marketing people in the first phases of the acquisition process.

An innovative trade fair stand was developed for PTT Autolease for the Freight Trade Fair in Rotterdam in 1993. The trade fair stand formed a part of a nation wide publicity campaign to promote the change of name from RAC to PTT Autolease and introduce it to the market. A *Full Motion Full Screen Video CD-i* was developed, to act as an eye catcher at the trade fair stand, this received a lot of attention from the Freight Trade Fair visitors.
The development costs for the CD-i were about 150,000 HFL. PTT Autolease describes the value added of MM as follows:

- Presentation is improved and more attractive than company videos.
- The interactive element and game box elicited enthusiastic responses from the trade fair visitors.
- It gives an original/innovative impression.

The idea of a VR gaming environment using a helmet and VR suit was abandoned at an earlier stage as the VR technology was too unstable and the equipment costs were too high. The trade fair stand won the best stand award at the Freight Trade Fair following judgement by an independent jury. The trade fair stand was reused at four other shows in 1993 and 1994. The CD-i is also shown at the entrance of the PTT Autolease main office. Besides, a CD-i was developed by the PTT Research PROMISE project during the second half of 1993 to gain experience with the CD-i for promotion of PTT Telecom mobile telecommunication products.

The following descriptions of the M&S business objectives and information processing tasks, MRS functions and MRS implementation aspects are based on interviews with PTT Autolease, market studies in relation to the PTT Autolease publicity campaign (Kesselaar & Siero, 1993; NIPO, 1993), and the experiences of PROMISE researchers with the development of a CD-i for promotion of mobile telecommunication products (Hoogeveen, 1994).

3.6.2. Business objectives

The business objectives (O) for developing an MPS are to help - as part of a PTT Autolease trade fair stand - to make the name of PTT Autolease and services it offers well-known (O₁) and to create an innovative image for PTT Autolease (O₂). The PTT Autolease managers believe that the MPS helped to create the desired, innovative image at the trade fairs visited. PTT Autolease sales people reported that the MPS was an effective tool to attract a lot of attention from visitors at trade fairs. The business objectives of the MPS are very modest in comparison to the business objectives of the complete publicity campaign. The business objectives PTT Autolease wanted to meet with its publicity campaign were to increase sales volume (2000 extra lease-contracts) and to increase its market share in the Dutch autolease market.

PTT Autolease sees becoming well-known and an innovative radiation, as necessary conditions for increasing sales volume. Strong management commitment was given to the publicity campaign by the PTT Autolease management and by the board of directors of the parent company KPN. Apart from being present at trade fairs, the complete publicity campaign included bill boards advertising, radio & TV commercials, business presentations, sending press releases to news agencies, and magazine advertisements.

After the publicity campaign, an independent Dutch market survey (NIPO, 1993) showed that 43% of the respondents recognised the name of PTT Autolease. As a result PTT Autolease ranked 7 in a group of 15 competitors. This is not a bad result for a new player in
the field, but it is thought that PTT Autolease also benefits from the well-known name 'PTT'. An independent market survey (Kesselaar & Sier, 1993) \((n=222)\) showed that the unprompted response ("What car lease firms do you know?") with regard to the name 'PTT Autolease' increased from 1.4% in January 1993 to 3.3% in May 1993. The prompted response ("Do you know PTT Autolease") increased in the same period from 39% to 54%. The 1993 increase in sales volume was 400 extra lease contracts in the Dutch market (the target of 2000 extra lease contracts was too ambitious). The exact contribution of the MPS to the results of the publicity campaign is unknown, but probably modest.

One can imagine that the business objectives of a promotional system can be extended. For example, by promoting a product in a number of different places. An MPS can be used outside the trade fair environment. It can be used at more locations where customer or visitor contact takes place. For example, it can be used at every PTT Autolease office and for business presentations at the customer's site. One can also imagine that direct marketing objectives are relevant when promotional disks are sent as part of a direct marketing action. The effectiveness of such promotional actions depend of course on the number of disk players in the market.

Another possibility is to use the promotional disk for internal promotion so that, for example, new PTT Autolease employees can learn about the services offered by the company with less instructional effort, however, for instruction purposes other types of information items probably need to be included, such as technical manuals, sales specific information, etc. It is probably therefore wise to handle instruction and training by separate systems and not to mix promotional material with training objectives.

The management of PTT Autolease chose for a multimedia promotion system because they assumed it would help to create an innovative image of PTT Autolease (O2) and support the general trade fair stand objectives (O1) by attracting attention and evoking enthusiasm.

### 3.6.3. Information processing tasks

PTT Autolease needs to be present at car and freight trade fairs to meet its promotional objectives. The MPS is part of the trade stand, where M&S people promote PTT Autolease and the services of PTT Autolease.

Visitors can look around the trade stand which includes a small photographic exhibition, and can pick up leaflets and a catalogue from PTT Autolease. They can also be obtain information about PTT Autolease and its services personally from the marketing and sales people. The visitor can ask general or specific questions, and if the more interested visitors want to keep in touch with PTT Autolease they can leave their business cards. Marketing and sales people from PTT Autolease will then take care of follow-up.
The MPS can be used by visitors to obtain information about the services offered by PTT Autolease, without being approached by a PTT Autolease employee. This relieves both the marketing people and the customers. The services offered by PTT Autolease are:
- leasing of passenger cars;
- leasing of trucks;
- customising vehicles for security (police), delivery (carriage of goods) etc.

With regard to leasing vehicles it is necessary to explain complex lease constructions like sale-and-leaseback and car fleet management, and that a trade fair visitor goes away with an attractive visual impression of the services of PTT Autolease.

PTT Autolease has not considered the use of promotional CD-i's as hand-outs for trade fair visitors, though this idea has, for example, been used by handing out the 'Mobile telecommunication' CD-i of PTT Research after demonstration sessions. Using hand-outs takes advantage of the fact that people like to have something physical, as a memento of a presentation; as a free gift a sparkling CD has an attractive, high-tech image. A clear, current, limitation of handing out CD-i's is that most visitors will not have equipment to play the CD-i at their office or at home. This need not to be a serious limitation from a marketing point of view if the CD-i, with its printed label, is appreciated and attracts the desired attention.

The possibility of supporting, using the MPS, intake of visitor data, particularly name, address and company name and address is also not considered by PTT Autolease. Another
interesting option is to use a CD-i to support the customer’s service selection process. Still another interesting option for an MPS is to support order intake, although this brings us into the realm of other SSSs discussed previously.

3.6.4. System functionality

The MS and database system functionality are discussed together, this is possible because of the simplicity of the functionality of the PTT Autolease MPS. An overview is given in figure 22.

![Functional aspects diagram](image)

Figure 22. Functional aspects.

The main system function is:

- **Presentation of lease services**: the user interface of the MPS allows a trade fair visitor to access lease information from the promotion database. This lease information concerns general lease constructions, sales and leaseback, car fleet management, service stations of PTT Autolease, and the construction workshop. Lease services information is produced by advertising agencies and the marketing department and is updated directly. PTT Autolease has considered to extend new system versions of the presentation function with possibilities to manipulate objects, to drive vehicles through traffic (with the assignment to bring the vehicle home safe), etc., to improve the gaming element (attractiveness, interactive involvement) of future MPSs.

Several extensions of system functionality can be considered on the basis of extensions of the information processing tasks, discussed in the previous section:

- **Selection of lease services**: visitors can select vehicles, and choose customisations. The result is animated to help the customer visualise the effects of his choices.
- **Visitor data input**: visitors can be asked to enter personal data, like business card data or other data that is of interest from a marketing or sales point of view.
- **Remote database access**: remote database access functionality will be needed to retrieve topical price information and visitor data from external databases.
• Tele-ordering: a telecommunication extension can support the ordering process, which may lead to a competitive advantage: if customers have a PTT Autolease ordering terminal within reach they will be persuaded to use it if it is easier and faster than ordering by phone.

3.6.5. Implementation aspects

First, general MRS implementation aspects, then, some MDBMS implementation aspects are discussed in this section.

The trade fair set-up of the MPS includes stand-alone game boxes with built in CD-i player, colour TV monitor with stereo loudspeakers, and mouse with trackerball for menu selections. The game box looks like a game machine box in an amusement arcade. Seven game boxes were used for a large car show in the RAI in Amsterdam. A joystick can replace the mouse with trackerball for quicker and more accurate cursor control. If more stable and affordable VR technology becomes available, VR elements like VR glasses (or a VR helmet) might be used as the output medium for a more vivid experience of the services offered by PTT Autolease services. Although this goes beyond the limits of current CD-i technology, speech interaction (recognition and production) would enhance the desired gaming impression.

The CD-i was designed by an advertising agency and is produced by a CD-i production studio. This production studio offered one of two European facilities to encode MPEG1 video real time (25 frames per second) on Silicon Graphics Onyx computers. The CD-i title was programmed in C and the Balboa authoring environment of OptImage Interactive Services. The low circulation (only seven CD-i's were produced) did not justify mastering the CDs, so CD-Rs were used. (The critical number for mastering was a circulation of about 25 if 1994 price lists are taken into account). The inclusion of a telecommunication function (for remote database access) would require a telephone connection, a modem, and adaptation of the CD-i title. The CD-i title controls the modem and remote database interaction, an alternative would be a PC-based MPS with a modem connection.

What information types are present in the user interface of the MPS of PTT Autolease? The CD-i Full Motion Video cartridge is used to display MPEG1 video. Video fragments are used to show such things as the PTT Autolease office, the reconstruction work shop with welders, trucks in the garage and on the road; presented together with traffic, work shop and office noises, they give a dynamic impression of the firm. Music is sometimes played in the background. Speech and long texts are used to explain the services offered by PTT Autolease. A trouble with long texts is that it takes time and patience to read them from screen (screen texts are far more difficult to read than printed paper text (see chapter 4)). Pictures are used to show the office buildings of several PTT Autolease service centres. Graphics are used to style menu buttons and the screen lay-out. The way these diverse information types are composed give a well thought outlook and makes a good impression.
Since high level computer skills can not be expected from customers at a trade fair the retrieval functionality at the user interface is kept simple: a hierarchical menu interface for retrieval by menus and selecting buttons on the screen is enough to start a presentation. An improvement of the interactivity of the MM presentation system can not only be obtained by adding interactive game elements but also by adding interactive retrieval elements. As is found with the 'Mobile Telecommunication' CD-i produced by PTT Research, the user interface can be improved by offering hyperlinking, graphical browsers and, in case of longer texts, key word search functions. A touch screen interface would be necessary for a key word search for the quick selection of characters from a graphic representation of a keyboard, as a physical keyboard is both uncommon and unnecessary for public (CD-i) systems. When adding retrieval functions one should avoid making the retrieval interface too complex, so that the trade stand visitor becomes confused when confronted with a vast number of buttons and paths of reference.

The MDBMS implementation aspects of the MPS are limited. No real MDBMS is used in a CD-i environment. A CD-i title is an integrated whole of data and program code for interaction. The CD-i RTOS (Real Time Operating System) controls the CD-i system, all retrieval facilities used are offered by the authoring environment and are programmed. The retrieval functions mentioned above that can be offered in the user interface would not really require a real MDBMS.

If, however, the lease service database needs to be updated often, the size of the title exceeds 650 MB, or more advanced retrieval facilities need to be offered it becomes necessary to reconsider the CD-i platform in favour of a PC platform, this would allow the implementation of an MDBMS and updating of databases.

Standard DBMS aspects become relevant when remote databases are accessed. The remote price or visitor database can be located on a server, and includes standard DBMS facilities like a relational DMF, a database language SQL, and an import facility for order records send by a Tele-CD-i.

3.6.6. Discussion

A striking strength of the MPS for the Freight Trade Fair is that it evoked the enthusiasm of the management, PR, marketing and sales staff of PTT Autolease and of visitors to the trade fair. The award for the most appealing stand at the Freight Trade Fair in Rotterdam, although not completely contributable to the CD-i, reinforced the idea that PTT Autolease had made a good decision in investing in an MPS. These are positive indicators for the viability of the MPS, and this reinforces PTT Autolease to proceed further with this type of promotion. However, a structured evaluation of visitor responses was not performed, so quantitative data about the effectiveness of such an MPS is not available.

It is interesting to note that the publicity campaign seems to have been effective (although the increase in sales volume was somewhat disappointing); however, on the basis of available data, it is not possible to isolate the CD-i variable in relation to increased sales volume and the name of PTT Autolease.
The PTT Autolease management sees as a success factors for their CD-i project:
• the choice of MM: at present it is new and innovative, you can score with it;
• the help yourself aspects: no sales person is breathing down a trade visitor's neck;
• the interactivity and gaming outlook: people are more attracted and involved then when using conventional company videos and leaflets.

A critical note was sounded in that the visitors were somewhat disappointed with regard to the interactive gaming elements since it was just a point of information with no real gaming possibilities. The business objectives are probably met better if the interactive gaming elements are improved.

Bottlenecks found during system development are:
• time pressure, resulting in a less well thought-out CD-i title than actually possible;
• lack of IT expertise at PTT Autolease and no access to independent expertise;
• no direct communication with the producer since the advertising agency acted as an intermediary, resulting in some loss of control of the development process;
• dissatisfaction with the price performance ratio;
• lack of stability in Full Motion Video technology at that time.

A further criticism in relation to lack of IT expertise, is that often no clear argumentation is given why certain tasks are, or are not, supported by the MPS. It seems as if the implementation limitations of the CD-i platform controlled the definition of system functionality.

In conclusion, with a small firm like PTT Autolease, the authoring of CD-i or Tele-CD-i titles can not be performed in-house, as the production volume is too small to justify investing in a CD-i authoring system (which costs about HFL 100,000.-); however, a large organisation like KPN, or its subsidiary PTT Telecom, is able to extend its audio-visual production or automation centres with a CD-i and/or CD-ROM authoring task.

3.7. Multimedia Assisted Instruction (MAI)

3.7.1. Introduction

MM or Multimedia Assisted Instruction (MAI) is one of the most active application fields for MM, this is not only the case in university settings, in which instruction is a primary process, but also in industry. A MAI system is multimedia courseware, supporting an individual or group learning process relatively independently of teaching location and teaching time, in which an interactive element and media richness are used to improve the learning effect. The most often heard arguments for MAI (it is used here interchangeably with Hypermedia Aided Instruction) in comparison to conventional courses are (see also chapter 4):
• higher learning effectiveness: better retention and better understanding;
• higher learning efficiency: steeper learning curve (less instruction time), and self training or training on the job (fewer instructors, less travel);
• higher productivity: the number of trainees per instructor or course is increased;
• meaningfulness: it is more fun and helps to create the impression of an innovative firm, it has a PR value.

The following descriptions of the M&S business objectives and information processing tasks, MRS functions and MRS implementation aspects are based on contacts with the TSA project (Tele Sales Assistant project, see section 3.4.), experiences within the PROMISE project, and examples from literature.

3.7.2. Business objectives

Several cases are described simultaneously because of their similarity, namely TSA training, the Agfa disk case and the Interactive Service Handbook case. For TSA training the main business objective is:

• to reduce the waiting time for telesales training (O₁) by increasing training productivity, and thus increase the level of product and service knowledge of the telesales people.

Since the turn over of telesales people at telesales centres is high and call pressure is also high, it is important to profit from telesales people from the beginning. There are about 1000 telesales people, with a mean waiting time for a training of about 2 months. Since extending training capacity by hiring more instructors is expensive, an MM training module was designed which offers self-help training on the job.

The second case is that of the Agfa disk. Agfa is an important producer of film and photographic equipment for both the amateur and the professional. The medical division of Agfa had, in 1991, a 20% share (4 billion dollars) of the total revenues of Agfa. The main products for the medical world market are X-ray film and professional medical cameras for radiology departments.

The business objectives for developing a MAI are for Agfa (Kustermans, 1991):

• to reduce training costs (efficiency) (O₂): Agfa expects to reduce the number of return flights to Antwerp and Munich, where the international training centres are, by 70% and expects to reduce the duration of training by 30%;
• to increase the training effectiveness (O₃);
• to offer sales support to customers in the form of a self help system for acute problems (O₄).

The advantage of adding sales support as an objective is that the same MM product can be reused for another purpose without much additional costs. The expected savings on travel costs are about 1 million HFL per year, those from reducing course duration about HFL 0.5 million a year. These projected yearly savings surpass the initial development costs of a CD-i by at least a factor 10!

The BU NWB (network company) is responsible for the management of network services within PTT Telecom. The functions of these services is often little understood by marketing
and sales staff within PTT Telecom. Therefore the idea was launched by PTT Research and NWB

- to improve internal knowledge of network services (O5) using Interactive Service Handbooks.

An interactive service handbook contains information which is already available, but not in an accessible way. Currently, service information is available in paper handbooks which are hard to digest.

Interactive Service Handbooks can be seen as a MAI application and the estimated costs for producing such a MAI application are HFL 80,000.-.

Another objective of MAI can be to improve support by ISs like the TSA system discussed before. This can be in the form of intelligent tutor or help agents as part of the IS they use, which give immediately help when a user is in trouble.

MAI is interesting for NWB as it is assumed that a MAI will be effective in meeting objectives discussed above. This assumption is based on the effectiveness of MAI in assisting the learning process, as discussed in the foregoing section.

3.7.3. Information processing tasks

The courseware for the TSA training system is produced by teachers, and it is used by novice telesales people, individually or in small groups. This MAI system includes exercises with regard to the products and services offered by PTT Telecom to the consumer market, for example, wireless telephones, answering machines, etc. The TSA training system is intended both to teach novice telesales personnel how to use the TSA system, and to improve product and service knowledge.

In the Agfa case, the medical division is supported by a staff of 700 commercial marketers and about 600 maintenance technicians. Training is organised in the headquarters of Agfa in Antwerp in Belgium and in Munich in Germany. In the old situation, 600 flights per year were made to Munich or Antwerp to teach small groups of technicians how to install, maintain and repair medical cameras, having the size of washing machines, in 1 to 3 weeks.

A CD-i disk was developed for Agfa which is distributed to all Agfa establishments throughout the world, making it possible to train technicians on the job. The CD-i is also used by commercial sales people, and is given to customers as a handbook to accompany their medical camera. The advantage of using pictures is that it helps to show very clearly how the cameras operate and how to repair the cameras.

PTT Research has proposed a MAI system in the form of Interactive Service Handbooks that can be used by different types of marketing and sales personnel: marketers, account managers, personal sales staff and technical sales staff. It is important for marketing staff to be given ideas on how to promote and position the services presented in the market, while for business and consumer market sales staff it is important to learn what the functions of products and services are and to communicate this information to their customers.
In more general terms, MAI systems can be used to train customers, maintenance technicians and sales personnel in understanding the use and maintenance of products and services offered by a company. A teacher can give feedback on test answers and trainee questions, and a teacher is involved in the production of a specific training course, though this is actually produced in an authoring centre. Such an authoring centre also takes care of the actual updating of MAI systems.

The training function of a MAI system for M&S can be extended by including training material about customer interaction (especially relevant in the case of the TSA system) and by including relevant information about marketing actions for sales people. This is probably necessary if a more complete course is to be offered to M&S target groups. The product and services information can be kept topical by offering on-line access to corporate assortment databases.

3.7.4. System functionality

This section gives a general description of the functions of the MAI system. General MAI system functionality (an overview is given in figure 24 below) is discussed first, followed a discussion of MAI database system functions.

The main system functions are in general terms:

- **Consultation**: The MAI (user) interface offers trainees the possibility to retrieve and consult interactive MM material on the subject matter. The MAI interface retrieves subject matter information from the MAI database system. The information is presented in a structured way. All three systems, the TSA training system, the Agfa disk and the Interactive Service Handbook include a consultation function.

- **Testing**: The MAI interface can include a test or examination function. The test function retrieves test questions from the MAI database system, presents them to the trainee who then responds. The trainee's responses are stored in the MAI database
system. The test function gives feedback to the trainee about his or her test results. The TSA training system contains a test module. A test module is planned for the Interactive Service Handbook.

- **Analysis of test results**: the teacher is supported in the analysis of trainee test results. The analysis function retrieves the test results of trainees from the MAI database system, computes their test scores, and presents them graphically to the teacher.

![Diagram of MAI system](image)

Figure 24. Functional elements of a MAI system.

In experimental MAI projects, functionality for MM teleconferencing (Crowfort *et al.*, 1991), and computer supported co-operative work based on broadband (Kindt *et al.*, 1991; Pehrson *et al.*, 1992) is sometimes included. On the basis of these developments we can anticipate several extensions to system functionality:

- **Teacher consultation**: the MAI interface might offer functionality for real time or delayed consultation of a teacher.
- **Study group co-operation**: the MAI interface might offer functionality for real time or delayed communication and co-operation with other trainees. Trainees would be able to study together and work collectively on tests.

### 3.7.5. Implementation aspects

The MRS implementation aspects for the three MAI systems are discussed in this section. First, general MRS implementation aspects are discussed, then MDBMS implementation aspects.
The MAI interfaces of the Agfa disk and TSA training system offer retrieval by menus and hyperlinking using selecting buttons on the screen. The MAI interface of the Interactive Service Handbook includes graphical browsing of an overview of related items, key word searches and a possibility to search full text using technical specifications.

The TSA training system uses the same information types as the TSA system: text descriptions of products and services and pictures of products. An experimental stage video is used in addition to pictures and the other standard information types included in the TSA system. The TSA training system is a module of the TSA system. This module is controlled by keyboard and mouse, and uses PC S-VGA screens for display. The teachers in the editing environment need, in addition to the TSA system editing tools, tools to capture, code, and edit video data in AVI format. The update process uses similar transmission media to the TSA system.

Information on the Agfa disk on CD-i is structured in the same way as a conventional manual with chapters. Pictures are used to present the medical cameras, these can be manipulated by the trainee: power can be switched on or off, and camera pieces can be removed to view the interior of the camera. The trainee can zoom in on components. Sound is used to give an impression of the camera in operation. Sound and pictures are also used to simulate operational problems. Text explanations are used for example, to help the trainee to solve operational problems. Graphics are used to depict icons (e.g., a hand holding a spanner to start the chapter customer support), and screen lay-out.

In the case of the Interactive Service Handbook video is used to present real life usage situations. Animations and graphics are used to present complex and abstract services in an understandable way. Pictures of equipment can be presented and buttons and levers on the pieces of equipment can be manipulated to show how services operate. The handbook contains the text of available handbooks.

More advanced MAI systems include the implementation of some extensions.

- Teacher consultation and study group co-operation can be supported by MM mail and by a desktop videoconferencing system.
- for technical sales training especially (as is the case with the Interactive Service Handbook and the Agfa disk) VR elements can help to improve the reality value of interactions with simulations of equipment. VR elements will make it completely unnecessary to use real medical cameras or other equipment for training in maintenance or operation skills, as the 3D visual, auditive and haptic experience obtained using the VR application is similar to reality. Although VR is possible today, it will take some time before VR systems are cost-effective for training of M&S people.
- Today, telecommunication extensions for access to topical assortment databases require ISDN (or PSTN) connections, and ISDN30 (2 Mbit/s) if real time MM data is transmitted.
- To identify trainees and store their results chip cards, diskettes or hard disks can be used. Currently, chip cards have a limited storage capacity, but this storage capacity is increasing rapidly.
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The authoring centre needs to be equipped with tools for MM information processing and MAI authoring. With the development of the editor function the authoring environment will evolve. The more different information types are used, the more different tools for capturing, coding and editing are necessary. These tools need to be offered in a simple integrated environment which also allows for teachers, often not the most IT minded people, to edit their material. For remote editing and/or updating of MAI applications a public network connection is necessary. When coding equipment improves MPEG1 and MPEG1 successors can be used to produce full motion video and CD quality audio.

The **MDBMS implementation aspects** of the Agfa disk on CD-i are limited because of the platform chosen. The TSA training system is implemented in a PC environment and uses the search and presentation facility of the Microsoft Access DBMS under MS-Windows. If the TSA training system is used in connection to ORACLE databases, Interactive Service Handbook and other MAI courseware within PTT Telecom, will profit from topical central assortment information. The exchange facility and update facility of an MDBMS will then be needed. The MM data of the TSA training system is currently stored in directories and not in Access database files. In the Interactive Service Handbook the external models describing the presentation aspects of MM objects, and the MM objects itself can be stored in MM databases. The MDBMS selected needs to be able to support at least the storage and retrieval of BLOB data type. The search facility of the MDBMS selected should use an extended SQL database language that supports the consultation function of the MAI interface, for example, in the form of Query By Example screens.

**3.7.6. Discussion**

MAI systems are clearly technically feasible and seem viable, particularly when we look at the Agfa disk and TSA training system. The greater the reduction in training costs (travel, lost working time) the more viable a MAI system is. The value added of MR for MAI systems is based on more effective learning and quicker disclosure of relevant knowledge. As is the case with most MAI courseware, the three MM self help training on the job applications described are or will be used single user or even stand alone (Agfa disk). The advantage of PC based MAI is the ease by which material can be updated on-line on a regular basis and MAI functions can be integrated with other applications. This makes it possible to migrate towards on-line help software offering intelligent assistance to sales people using SSSs. This advantage is not available in the case of CD-i based MAI, however, a CD-i can be distributed easily by mail or distributed with goods (e.g., a medical camera) or handed out personally to customers. Moreover a CD-i can be played on standard and cheap equipment, in contrast to PC based MAI systems.

In the Agfa and TSA courseware cases, little use is made of retrieval facilities, as little knowledge was available about the advantages and disadvantages of retrieval facilities for certain applications. The Agfa disk is one of the earlier CD-i and MM applications, and therefore incomplete use is made of the audio-visual and interactive possibilities of the
medium. An especial strength of the Agfa case is that the benefits are estimated quantitatively and resulted in an acceptable Return On Investment; as yet a post-measurement is not available. This phenomenon that the effectiveness of an MR application for M&S is not measured has been reported before, and seems symptomatic of MM applications in general.

3.8. The Marketing Documentation Archive (MDA)

3.8.1. Introduction

A Marketing Documentation Archive (MDA) is an on-line central archive for the storage and retrieval of valuable marketing documentation, that support document centred back office marketing processes. For larger organisations especially, an MDA may result in synergy effects, efficiency gains such as increased reuse of these marketing communications materials.

The marketing documentation contains only non-promotional marketing documentation, in contrast to a Marketing Communication Archive.

This envisioned MDA system is based on experiences with the Criminal Investigation System of the Dutch police, OCTOPUS, for retrieval aspects (Hoogeveen, Van der Meer & Sol, 1992b; Hoogeveen & Van der Meer, 1994), and the PTT Research PROMISE project for MR and M&S aspects.

3.8.2. Business objectives

The business objectives of an MDA may be analogous to the business objectives for an MCA:

- more efficient archive management, storage and retrieval (O_1);
- improved document processing support of marketing departments using the MDA (O_2);
- improved management insight into MDA costs and performance (O_3).

In the current situation no clear MDA function exists. In fact the MDA function is distributed over the hundreds of small secretariats within the PTT Telecom marketing units. This probably means that archive management, storage and retrieval is not organised economical (O_1) since specialist archivists may perform better, especially if a central MDA system is supporting them. In particular, retrieval of documents, having a department exceeding value, is more efficient when direct access by interested marketing people is possible. Manual retrieval from a physical archive is also inefficient, this is a common and time consuming activity. Information retrieval reduces retrieval times to minutes, saving the valuable time of marketing people and their secretaries. The physical reproduction and
distribution of documents is also time consuming and thus expensive. Further, efficiency can be improved by electronic reproduction and distribution, but one should be aware that this will induce local printing of documents since people prefer to read from paper rather than from computer screens.

With respect to efficiency we should consider the structural system management costs of the MDA, which need to be recovered by the efficiency and other gains.

*Document processing support* can be improved significantly (O₂) by setting up an MDA function. The MDA would guarantee short delivery times for required documents. It is also possible that electronic versions of documents are delivered, this is rarely the case in the current situation. The advantage of electronic documents are that they can be reused for new documents using cut and paste functions, and they can be very easily reproduced and distributed by e-mail to interested people on an electronic distribution list. Reuse of parts of documents is extremely common: often marketing plans are updates of older ones, many documents have similar objectives and/or have an overlapping content. Another very important document processing support aspect of the MDA is that valuable marketing documents become available company wide, and that these documents are not lost.

Sometimes it is important to get *more management grip on and insight into* marketing document processing costs and performance (O₃). As is the case with the MCA, this control and insight is not available if the MDA function is scattered, but it becomes available if the MDA function is centralised. Centralisation versus decentralisation is a policy issue, which should be resolved before the MDA is set up. It is important, however, to realise that IT is malleable, like wax, implying that both centralised and more distributed solutions can be supported.

Another aspect of management grip on an MDA is that the integrity and quality of documents can be checked and evaluated centrally. Company policies and changes in these policies with regard to quality and authorisation of documents can be applied easily and without delay.

Yet another aspect of management grip is the possibility to perform flexible authorisation management. If some documents require a certain level of authorisation this can be arranged by assigning privileges to users and security levels to documents; it is also possible to assign documents to certain closed user groups.

It is assumed that setting up an *electronic* MDA is more efficient (O₁), that it helps to improve document processing support (O₂) and helps to improve management insight and grip on document processing (costs) (O₃). The choice of a *multimedia* archive may be made because of the nature of many marketing documents. These documents, as do many documents today, include graphics and pictures. It would be counterproductive to remove all graphics and pictures.
3.8.3. Information processing tasks

If an MDA is going to be introduced, what information processing tasks are to be supported?

An MDA supports the storage, maintenance, retrieval and distribution of internal marketing documents like marketing plans, promotion plans, plans for market pilots, and market and marketing research reports.

Further, an MDA offers access to commercial on-line marketing databases (i.e., secondary data). The marketing staff and their secretaries may retrieve and store documents on-line or via an MDA archivist. The archivist is responsible for unhampered retrieval and delivery of marketing documents, and access to secondary data. The archivist provides management with marketing reports on the use of the MDA, and updates the MDA if new (authorisation) policies need to be implemented. If the MDA system itself needs to be updated then a system manager or system developer is needed. Apart from the electronic MDA system a physical MDA is used to store special documents. Such special documents are, for example, historic documents or documents having a legal value.

Documents can be electronically distributed to anyone on a send list. This implies that the MDA may also have the function of supporting document flows through the marketing organisation.

A number of information processing tasks that can be supported by an MDA are discussed above. Some additional options are:
• MDA support of mail registration and archiving by marketing (and other) secretaries. This brings into the picture a customer relations function. Thought must be given to whether such a business relations functions should be combined with the marketing documentation function.
• An MDA might include general purpose business presentations: sheets that can be reused or have just an informative function.
• Another option is to take care of links to other systems like the MCA. It is possible to foresee a marketing document in the MDA that refers to a video or picture in the MCA and vice versa.
• Another possible option is to offer document life cycle support to marketers, i.e., that documents are routed through the organisation until they become obsolete and need to be deleted.
• Consideration should be given to offer market research organisations, that perform market research for PTT Telecom, restricted access to the MDA. These organisation can look up certain non-confidential reports, and can store and distribute their market reports via the network. It is of course clear that the security of the MDA should not be endangered by such access from external organisations.

3.8.4. System functionality
A description of the functions of the MDA system is given in this section. First, general MDA system functions (see figure 26) are discussed, then MDA database system functions (see figure 27).

The main system functions are:
• Document retrieval: the MDA interface offers archivists, marketing staff and their secretaries document retrieval functionality. The document retrieval module sends retrieval and presentation requests to the MDA database system or to the external database interface for access to external marketing databases. The MDA database system or external database interface returns result sets and presentable documents.
• Distribution: an MM mail system, connected to the document retrieval module, offers the user of the MDA system the possibility to distribute retrieved documents to people on a send list. The distribution module can also accept input documents which need to be stored in the MDA database system.
• Optical reading: the archivist is able to use an optical reading system for the input of non-electronic documents to the MDA database system. Both machine written and hand written text can form input.
• External database access: this function offers integrated access to commercial on-line databases for document retrieval. Retrieved documents can be imported in the MDA database system.
• Report generation: the archivist and marketing management can use the report generation function to abstract management information from the MDA database system, with regard to the use of the system.
• **Maintenance**: a maintenance function can be used by the archivist and system manager to update authorisations, to delete obsolete documents and to update indexes, etc.

![Diagram](image)

Figure 26. MDA system functionality.

![Diagram](image)

Figure 27. MDA database system functionality.
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The main database system functions are:

- **Searching:** the search facility offers the MDA interface search functionality. The MDA interface sends queries. The search facility returns result sets. The authorisation database is consulted to check the authorisation of the user for searching certain categories of documents.

- **Presentation:** the presentation facility accepts presentation requests (including references in a result set) from the MDA interface and returns information objects from the document and send list databases. The authorisation database is consulted to check if the user is authorised to retrieve the document.

- **Exchange:** the exchange facility is used to export document selections together with the associated send lists. Further, the exchange facility is used to import documents via the external database interface. The exchange facility can update the document and indexes databases directly or indirectly via the update facility.

- **Update:** the update facility offers document updating and indexing functionality in connection to the MM mail system and optical reading system. Further it offers update functionality to the MDA interface for the updating of the send list database and authorisation database. (Updating includes adding, replacing and deleting documents)

### 3.8.5. Implementation aspects

An implementation *scenario* for the MDA is discussed here. The MRS implementation aspects for the MDA system are based on the MDA system functionality (see figure 26) and the MDBMS aspects are based on the MDA database system functionality (see figure 27).

The *MDA interface* consists of PC/MS-Windows based access software. The PCs make use of a LAN connection to print documents.

The editing or authoring of documents is done using the standard word processor (part of T-Workplace) of PTT Telecom, that is gradually upgraded by newer versions. Upgrades of T-Workplace can include an upgrade towards Multimedia PCs, which offer the possibility to digitise VHS or S-VHS video, and audio tapes, and afterwards edit the audio and video files. Further, these MPCs can contain CD-ROM drives for the input of digital text, audio, video, animation, etc.

If business presentations (sheets) are to be included in the MDA a business presentation tool is needed as part of the standard workplace. Audio and video cards are required in the MPC for presentation of MM documents with a high audio and video quality. No special video boards are necessary for low quality video, for example, video for windows (AVI).

The MDA interface offers easy to use document retrieval facilities like hyperlinking, graphical browsing, QBE, and a hierarchical menu-interface for all types of users. Full text searches using inverted files and set manipulation for incremental searching are possible for somewhat more advanced users.

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To improve precision and recall, the MDA interface, as far as support of archivists is concerned, includes enhanced IRS facilities, such as a thesaurus, ranking and clustering, an (inexact) query language, and the set up and maintenance of search profiles as part of a service to the customers.

An MM mail system is used to distribute documents. Special tools, like Lotus Notes, can be used for document flow support. MM mail software or document flow software is integrated with the software environments of the user PCs and the MBC database server. The exchange of MM documents will result increasingly in an overload of the business networks used. A consequence of this is that the business networks will need to be upgraded. For example, LANs will need to be upgraded towards MM LANs (e.g., 100 Mbit/s Ethernet-LAN).

An optical reading system is used by the archivist for the input of printed documents. The optical reading system consists of:

- a scanner, connected to an update PCs, to digitise a document;
- OCR and eventually ICR software on an update PC for character recognition.
- a LAN connection to update documents to the MDA database system.

After (semi-)automatic document import the document arrives in the MDA database system. The MDA database system consists of an MDA server on a LAN. Remote access to the MDA database system is supported by an N-ISDN gateway to PCs in other LANs. The MDBMS facilities needed most are an update facility, exchange facility, search facility and presentation facility. The MDA database system is probably based on a full integration approach, external integration approach or extended DBMS approach using an MDBMS, which fully integrates IRS, DBMS and additional MDBMS facilities, as all the related facilities are needed together.

The search facility of the MDBMS supports full text indexing, SQL extensions, search profiles, thesaurus searches, and ranking and clustering as discussed above. To guarantee easy exchange of documents de facto document standards like WordPerfect and MS Word are supported. MS Word and WordPerfect are the most commonly used word processors. All graphic, audio and video information that is accepted by such a de facto document standard is accepted by the MDA system as well. A presenter for such a document standard is needed in relation to the presentation facility of the selected MDBMS. The conversion between MS Word and WordPerfect documents does not present a large problem for text documents, however, conversion of documents containing graphics, pictures and other information types conversion is troublesome. Use of de jure document standards like ODA and SGML is not effective, as no marketers use an SGML editor. With time, when the processed marketing documents have evolved into real MM documents, MM document standards will need to be supported. In this case de jure MM document standards, such as HyperODA or HyTime, might be accepted by business organisations and industry, and it is wise to use such MM document standards. If this is not the case, the next versions of MS Word/WordPerfect would be better.
Extending the DMF with support of the object oriented model makes it possible to take care of data definitions for MM documents of whatever document type. The external model, as presented to the user, will also be MM and object oriented. MM external models support the presentation of objects in time and space.

To code and decode MM objects, information coding standards like MPEG1, and its successors, will need to be supported by the MDBMS for more efficient storage and transmission of MM data.

3.8.6. Discussion

An MDA is technically feasible with current IT, but the viability of an MDA for marketing departments is highly uncertain. Not only because of hard to quantify business value added, but also because of 'business politics' when so many departments are involved in the change process. The major strengths of the MDA system are that clear business objectives, comparable to those of the MCA, are aimed for: increased archiving and retrieval efficiency, improved document processing support for marketing departments, and increased management insight. It is a drawback that the organisational costs can be quite high: the many marketing people involved and their secretaries need to change their way of working. Such costs have yet to be estimated. The assumed value added of MR for the MDA is based on more effective and efficient retrieval, and processing of realistic representations of original documents including multiple information types. Other strengths of the MDA system are the synergy effects that occur when IRS, DBMS and hypermedia facilities are combined in one MDBMS: both information retrieval specialists and ad hoc users can make use of the same system. Moreover, a growth path towards use of MM documents is supported. Since there is already a tendency for documents to contain more and more different information types (texts, tables, graphics, pictures) it is not unreasonable to assume that, within some years, MM documents containing time based data (video, audio, animation) will be exchanged within marketing departments.

3.9. The Virtual Market (VM)

3.9.1. Introduction

A free and public Virtual Market (VM) is realisable using MT. The VM is a global and public electronic market place, that has a transparent user interface, where demand can meet supply freely. An attempt is made, within the EURESCOM\textsuperscript{28} IMS1 (Integrated Multimedia Services at 1 Mbit/s) project, to specify a generic MM service (Simon, 1993; Hoogeveen, Lecoq & Balestrli, 1993); this can be seen as an MM successor to Videotex

\textsuperscript{28}EURESCOM is the joint research centre of West European public network operators for precompetitive research into telecommunication services. The headquarters of EURESCOM are located in Heidelberg, Germany.
(Hoogeveen & Andersson, 1993), and can be compared to a VM service. The VM service becomes a real VM when demand and supply meet each other freely, the VM infrastructure offers public access, and a low threshold for accessing the market.

The VM exists already, but is fragmented and in its infancy. To give examples: there are countless numbers of bulletin boards offering information products like games and pictures, electronic book shops, POSs offering a VR user interface of a shopping centre, etc. Experiments by AT&T and Silicon Graphics in Orlando with TV-1 will provide information about the technical feasibility and viability of setting up a VM service.

What types of M&S applications can be found in the VM? In the history of Videotex most applications fall into the categories banking and insurance, retailing and distribution, electronic publishing and travel agencies. (Online, 1984). In an MM successor new types of applications will probably be added that include video and/or audio data streams, like video on demand.

In principle there is no limit to the number and types of applications that may be offered in the VM. There will naturally be a kind of self-selection due to commercial viability of an application. An overview of research in MM telecommunication gives a good idea of the types of applications to expect in the VM. Research is performed on MM telecommunication systems for education (Gullickson-Morffit et al., 1992; Mühlhäuser, 1991), MM teleconferencing (Crowfort et al., 1991), computer supported co-operative work based on broadband (Kindt et al., 1991; Pehrson et al., 1992), electronic publishing (Consulting Trust, 1993), medical imaging (Vöge, 1992), video on demand (Venkat Rangan et al., 1992), financial information services (Arbuthnot & Khalil, 1993) and in many other areas of application.

After the introduction of the first generation of VM services, the next generation VM services will gradually evolve and improve. The continuous confrontation between demand and supply, and service competition between information providers will lead to the deselection of information services that have little value added and a low quality of service. The struggle for survival will sift the viable from non-viable information services. The creativity of human kind may result in yet unforeseen types of information services.

A gradual increase in the number and quality of MR products and MR services can be expected. These products and services will become more and more self-selling, making the sales staff of suppliers superfluous, to a certain extent. The VM will grow from national to continental to global, and will stimulate further the globalisation of the national and continental economies. It is possible that the economic value of the VM will grow to such an extent that it will overshadow the economic value of traditional non-electronic marketplaces.

The following descriptions of the M&S business objectives and information processing tasks, MRS functions and MRS implementation aspects are based on participation in the IMS1 project, and make use of knowledge of state of the art technology.
3.9.2. Business objectives

The business objectives must be seen from the points of view of the different actors in the VM place:
- the customer or purchase department;
- the information provider (IP), especially its sales department;
- the service provider (SP);
- the network provider (NP);
- the financial parties (FP).

The last three actors, the SP, NP and FP, are in fact facilitators. They are considered here explicitly because they are continuously and actively involved in keeping the VM service in the air and offering feedback on use of services and financial transactions as an integral part of the VM service. The business objectives (only in the case of private customers is it often not possible to speak of business objectives) are discussed per type of actor, below. Per actor the introduction bottlenecks, that form a risk for the viability of the VM service and for meeting the business objectives, are mentioned shortly. The facilitators SP, NP or FP can also act as an IP, but this will not be discussed here.

Two categories of customers may purchase the products and services of an IP: consumers or purchase departments. (Possibly the purchase departments of other IPs). There will be both professional and non-professional users. The main objectives for the customers are:
- reduction of purchase costs by efficient access to IP services or by discounts;
- meet demands not met before by being able to purchase, for example, new types of services like a personal news magazine;
- more choice between suppliers and their information services and products;
- improved infotainment (in case of consumers).

A number of introduction bottlenecks can be seen in relation to the customer agent:
- the availability of an affordable and flexible bandwidth;
- the availability of affordable equipment;
- business value added of information services for customers;
- end user acceptance, which depends on the usability of the VM (applications) and resistance to change.

The IPs in a VM are those companies or persons who have invested in a certain application, in a certain information service. An information service consists of the information provided and the functions programmed to handle this information. The business objectives for IPs are to:
- (depending on the number of VM access points) extend their market penetration;
- increase the sales volume;
- reduce marketing & sales costs by making retailers and M&S personnel superfluous;
The Viability of Multimedia Retrieval Systems for Marketing and Sales

- obtain immediate and precise information about customer behaviour;
- obtain direct access to their markets and direct contact with their customers;
- improve quality of service by reducing delivery delays of information products.

Introduction bottlenecks for the IP are related to:

- the initial costs of setting up an information service;
- the difficulty of predicting in advance the success of an information service which depends on actual use by customers;
- lack of experience with an MM service;
- copyright protection of information provided.

SPs consist of the parties who offer the VM service to VM service subscribers. SPs maintain the information servers, the connections to the information servers and may be involved in the production of an application or specific information service.

The business objectives for the SP are to

- set up a cost effective VM service, to be profitable;
- to generate extra revenues for the shareholders, often NPs, some large IPs, existing SPs like Videotex and Minitel, and perhaps FPs.

Introduction bottlenecks are:

- lack of experience with MM service provision, e.g., multi-user aspects in relation to real time use of an application;
- uncertainty about Return On Investment (ROI) for SPs: when is the market ready for a VM service and in what form?

NPs play second fiddle in the VM concert. Their role is to provide the network connections between the entities involved, to offer - simply said - bandwidth, and to take care of network accounting.

The business objectives for participating NPs are to:

- generate more network traffic;
- offer new types of network services (Value Added Network Services);
- defend or extend its market share.

FPs, like credit card organisations or banks, need to open their financial infrastructures to the VM service to support real time financial transactions between, most importantly, customers and IPs.

The business objectives for FPs to support VM transactions are to:

- increase their market share by offering VM transaction processing services;
- increase efficiency by further automation of transaction processing.

An important introduction bottlenecks is:

- uncertainty whether there will be an acceptable ROI for setting up VM financial services.
A VM is only viable if the most important objective of these different types of actors are met: an acceptable ROI. Only if the VM services are clearly profitable for potential parties can they be persuaded to participate in a VM service consortium and in VM applications.

3.9.3. Information processing tasks

The VM is always part of a real market (see figure 28). In the foregoing paragraphs the roles of the customers, IP, SP, NP and FP are described in general terms. Their specific interactions with the VM are described in this section.

Three basic tasks of customers and suppliers are distinguished: purchase, production and sales (promotion and delivery). Firms can have both the role of a customer and a supplier. All suppliers that are involved in the VM act as an IP, because they provide information about their products and services.

The purchase department or customer browses through the information services, identify themselves (optional), and place orders. In return customers pay for the use of the electronic information services and the delivery of products. Delivered products can be electronic information products like electronic reports or home videos. Non-electronic products and services are delivered physical by the IP. The customer receives invoices and bank statements from the financial information service that is part of the VM service.

A purchase department feeds a production department with the semimanufactures that they have purchased. Non-electronic semimanufactures may be send on physically, electronic semimanufactures may be delivered by an MM mail service, such an MM mail service can be provided by a mail company acting as an IP or by the SP as a standard service. Production departments distribute, in their turn, their manufactures either electronically or physical via their sales department.

The sales department is recognisable as an IP, since it offers the information service in the VM. The IP has the possibility to update its own information service on-line, but it may also farm this out to its production department, a subcontractor or a service provider. The IP monitors the use of its information service, receives orders from customers, sends invoices, and receives payments from customers via financial parties.

The tasks of the SP, that has set up the VM, are to monitor use of VM services by all the other actors, to send invoices to these actors for the use of the VM services, and to update continuously the information services. Updating the service can mean maintenance, adding new information services or new functionality to the VM service, and removal of outdated information services or obsolete functionality. The SP also offers a production environment as a paid facility for IPs. The information services are produced in the production environment. Therefore content data needs to be created, gathered, edited and prepared digitally. Next, the information services are authored, tested and transposed to the service environment.

NPs view a VM service as a specific VANS (Value Added Network Service). The main tasks of a NP consists of offering variable bandwidth connections between access points for users, hosts, and the service management centres. Further, the NP monitors network use
constantly to optimise data traffic, and to account and bill for use of the network. Accounting and billing may be integrated with the accounting and billing for the SPs and/or IPs. Payments of VM users will be based partly on a fixed connection price and the price of network use. (The price for the complete service will also depend on the prices of information service use and products provided).

An FP receives all orders for financial transactions; from customers that have purchased a service, from IPs that order automatic payment or pay the SP or NP, from the SP and NP ordering automatic payment and settlements among themselves. The FPs perform financial transactions and give feedback in the form of bank statements, possibly via their own banking information services.

![Diagram](image)

Figure 28. Roles and processes in relation to the Virtual Market (VM).

### 3.9.4. System functionality

A description of the functions of the VM service (Jones, 1993; Hoogeveen & Van den Eijnden, 1994) is given. First, the general VM service functionality (see figure 29) is discussed, then the VMSE functionality (see figure 30).
Figure 29. Functional elements of the VM.

As can be seen in figure 29 several types of system environments are present in the VM; the term 'agent' is used to indicate that these environments can, to a certain degree, act independently and be intelligent. The types of environments are the customer agent, IP agent, service provider agent, Information Service Production Environment, network management agent, financial agent, and the most central environment, the VM Service Environment (VMSE).

- The **customer agent** offers access to the information services of the VM. The customer agents supports personal identification, order entry, navigating through the VMSE, using information services and payment for services used.

- The **IP agent** consists of functionality to monitor the use of its information services, to make small changes to its information services (e.g., repricing products), to accept orders from customers and payments via FPs. The IP agent may be connected to internal order administration and invoicing ISs, and logistic ISs, so that order handling is mostly automated.

- The **SP** is responsible for one or more service environments (VM nodes), support of the customer environments, and may offer an Information Service Production Environment (ISPE) as a paid facility for IPs. There may be many distributed VM service environments managed by one or more service providers. The **SP agent**
supports the SP in monitoring use of services, tuning the VM service environments, and invoicing related to use of services.

- In the ISPE the information services are produced for the VM. It is important to notice that we still speak of information services whilst most of these will be levelled up to MR services. For the production of information services content data need to be created, gathered, edited and prepared digitally. The information services also need to be authored, tested and transposed to the VM service environments. Three types of principals for the ISPE are presented in our model (see figure 29). The IP sales department has the possibility to update his own information service on-line. The IP also may farm this out to a production company or department with an electronic publishing facility. The IP can enter into the agreement with the SP, that the SP is responsible for production and maintenance of the information service.

- The NP agent monitors network use, optimises data traffic, detects queuing problems, reroutes data traffic, etc. Invoices for the use of the network are sent to the SP, who on-charge network costs to its service subscribers, or are sent to the financial agent.

- The Financial agent supports financial transaction handling. Transactions are received from the VMSE, are processed by the banking systems of the financial parties and are returned in the form of electronic bank statements and payments. Bank statements and payments are also registered in the VMSE.

Typical functions in these distributed VMSEs include:

- VM directory access: the VMSE interface offers the ability to present directory information about the information services provided. Directory information is extracted from the VMSE distributed database system.

- Information services access: a customer agent is offered access to information services selected from the directory. A dynamic interaction between the information service stored in the VMSE distributed database system and the customer agent is supported when an information service is used.

- VMSE monitoring: IP agents and SP agents particularly are interested in making use of VMSE monitoring functionality to present service use information. This information includes information about the number of transactions per service or subscriber, the time used per service or customer, and user interactions to analyse customer behaviour.

- Financial transaction manager: the financial transaction manager keeps track continuously of transactions made during customer sessions. The parties involved are informed. The financial transaction manager further processes and sends on invoices.

- VMSE distributed database system: the VMSE distributed database system is the core functionality, that manages the distributed databases containing information services, use of services information, and directory information. Information service updates
come from ISPEs and SP agents. The FP updates its financial services with new bank statements about payments.

![Diagram of VMSE](image)

Figure 30. Functional elements of the VMSE.

### 3.9.5. Implementation aspects

The MRS implementation aspects for the VM service are discussed here. First, general MRS implementation aspects are discussed per environment (see figure 29), then MDBMS implementation aspects.

There are two main ways to realise a VM: one, gradually update existing information services, like Videotex, or two, set up a completely new, and for its tasks optimised, environment, that is downward compatible with older services, and offers for that purpose Videotex/Viditel emulation. The choice made is a political and economical decision for the investors involved, and this is not elaborated further in this thesis.

The *customer agent* offers access to the information services of the VM. The hardware platform for the customer agent consists of a terminal with graphic display (PC or TV based), a flexible public network connection, local storage capacity (many GBs hard disk or CD-MO), multi-card reader (for cards like credit cards, bank cards, telephone cards, etc.), a decoder for MM data streams, audio and video boards, loudspeakers, printer, a video
camera (an 'eye' on the screen), and a built in microphone. Depending on customer requirements a tailor-made hardware platform can be devised.

The software component of the customer agent includes:

- the terminal operating system, e.g., DOS and MS-Windows for a PC or RTOS for CD-i, can be used with its related functions, including software drivers for the video overlay board, JPEG and MPEG decoder, multi-card reader and network card, and drivers for MM presentation;
- the VM shell, a preferably intelligent user-interface, that is activated by the operating system shell, and that contains general VM functions for personal adjustments, accounting and billing, accessing the VM service directories, obtaining general help, copying information to a personal directory or printing certain information, controlling the remote connection, changing the set-up, for example the language, and quitting the VM shell;
- local applications like a simple MM editor.

Serious problems that need to be solved at the customer agent terminal are clock synchronisation, out-of-sequence data packets, packets to packets jitter, and lost data packets (Richard et al., 1993).

The IP agent and SP agent are roughly similar to the customer agent, however, the SP agent in particular makes use of a high end terminal as the management of systems requires heavy processing power.

An application development environment needs to be composed for the production: the ISPE. The ISPE includes, in comparison with a customer agent:

- heavier computer platforms for processing MM data;
- access to specific information services in the VM for the retrieval of electronic semimanufactures;
- access to storage media using a D1 and/or VCR recorder, a DAT and/or DCC recorder, a CD-ROM/XA and/or CD-i player, a high resolution scanner, back-up tape streamers;
- input media like a caption camera for stills;
- digital processing including A/D converters, audio/video/still/graphics editors, audio/video special effects generator, MPEG1 encoder, JPEG encoder;
- MM authoring tools for the production of an MM information service;
- a customer agent simulator to test how an information service behaves in the customer environment and other agent simulators in so far as different from the customer agent.

The production of video and audio will probably be contracted out to audio studios and video production companies such as Valkieser in the Netherlands.

As discussed in the previous section it is the task of the NPs to offer the necessary bandwidth for VM sessions. They need to 'create' a virtual VM network (1.544 Mbit/s is enough for real time MPEG1 data stream with video and audio), consisting of many interconnected national networks. They need to offer variable bandwidth connections to the users and service nodes in the virtual VM network. This requires that investments must be
made to offer at least 1.544 Mbit/s to the home. Alternative possibilities for this are advanced copper systems like ADSL (Asymmetric Digital Subscriber Line) or HDSL (High-bitrate Digital Subscriber Line) (Hoogeveen & Andersson, 1993), and Passive Optical Networks (Vaalen, 1993). ADSL and HDSL can be used in combination with basic rate ISDN (2B + D) on the same twisted pair. Currently, ISDN-30 meets the MPEG1 bandwidth requirement, although it does not meet the efficiency requirement with regard to variability of bandwidth (variable bit rate). The price of ISDN-30 connections is also about 10 times the pricing of basic rate ISDN. An interesting alternative is formed by ATM in combination with PDH, for which standards have been developed.

The main realisation bottlenecks is that:

- at least 1.544 Mbit/s bandwidth to the subscriber is needed which is far more than that offered by standard and affordable switched telecommunication connections today.

After the introduction of a VM service a growth path towards higher video quality, requiring 4-10 Mbit/s for MPEG2, should be anticipated; if multiple video application sessions need to run in parallel manifolds of 1.544 Mbit/s bandwidth are also required. Again, this means that ATM based Broadband ISDN comes into the picture. The results with ATM based MM services are very encouraging (Armbrüster & Wimmer, 1992). An alternative is formed by the possibility of using CATV networks, although huge investments in introducing switching technology need to be made, however, the heralded introduction of the digital super highway, based on fibre to the home would remove the current bandwidth bottleneck.

The VM service must present itself as a whole to the user, although many VMSEs (VM Service Environments) may exist in different countries, which may make use of many information servers per country. The development of operating systems that support distributed MSs would be very useful (Leslie et al., 1992).

Important bottlenecks to overcome are the, compared to a situation with information servers connected to PSTN, up to 30 times higher demands related to throughput, access times of storage media and processing power in the service environments. This requires large investments and distributed solutions.

A VMSE consists of:

- one or more (clusters of) database servers;
- an extendible storage capacity starting with some hundreds of GBs on, for example, RAID (Redundant Array of Inexpensive Disks) or other storage media;
- hundreds of data communication connections offering at least 1.544 Mbit/s each (e.g., in the form of ISDN30 or ADSL connections);
- the MM databases containing the information services of IPs.

With decreasing hardware and transmission costs, the use of MM services in the VM will be stimulated. Improvement of price/performance ratios for storage media and processing power will make it cost effective to improve service environments so that they can handle still growing, very large, databases.
Let us proceed with the discussion about MRS implementation aspects by discussing MDBMS implementation aspects. In table 4 below an overview is given of four scenarios for the VM and the most likely integrational approach and retrieval facilities related to these four scenarios. The four scenarios are related to time: the hybrid scenario seems cost effective now, the short term scenario as yet, does not seem cost-effective, the middle term and long term scenarios (see next section) are more mature and will probably be cost-effective in the next century if a real data highway becomes available.

A first step towards a VM is made in the hybrid scenario. The main starting point for this scenario is that as much as possible data intensive data traffic is kept local on the terminal of the customer, and only less data intensive data traffic uses the network. Examples of such hybrid MR solutions are a PC with access to a CD-ROM for audio and video and a network connection for structured data, or a Tele-CD-i with audio and video on CD-i and a network connection for structured data. Such a hybrid scenario is used to reduce network costs for the customer, and to reduce queuing problems in the VMSEs. Therefore no real DBMS is used, only some search facilities.

In the short term scenario the complete VM databases are located on the distributed VMSEs. MPEG1 video and audio is send over the network using ADSL or advanced copper systems. The relational model is implemented only for some structured data, not for the documentary, audio and video data, since this would require too much processing power in the VMSEs. Further, no differences with the hybrid scenario can be seen, since these would threaten response times (system performance).

Only in the middle term and long term, are retrieval extensions made, when the price/performance ratios of processing hardware and networks have improved significantly. The most striking extensions for the middle term scenario are the full use of the extended DBMS approach making possible the implementation of the relational model, support of MM document standards like HyTime or HyperODA, more free use of search facilities in information services, and the availability of full text indexing. MM editing is also supported, this is necessary to produce MM information items like MR products.

The long term scenario, probably realistic after about ten years, i.e., after 2004, also includes implementation of the object oriented model, the support of pictorial and sound search, and the support of real time encoding and decoding of MM and hypermedia objects (e.g., by MHEG) for real time exchange of hypermedia objects between systems. The presentation facility is improved so that HDTV quality video and CD-DA quality stereo sound can be played.
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Hybrid</th>
<th>Short Term</th>
<th>Middle Term</th>
<th>Long Term</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Integrational approach</strong></td>
<td>external integration</td>
<td>external integration</td>
<td>extended DBMS</td>
<td>extended DBMS/Full integration</td>
</tr>
<tr>
<td><strong>DMF</strong></td>
<td>non</td>
<td>partial relational</td>
<td>relational</td>
<td>relational and OO</td>
</tr>
<tr>
<td><strong>Search facilities</strong></td>
<td>hyper search, QBE, graphical browsing</td>
<td>SQL, hyper search, QBE, graphical browsing</td>
<td>+ extended SQL, ranking/clustering, set manipulation, search profiles</td>
<td>+ extended SQL/inexact query language, pictorial search, sound search</td>
</tr>
<tr>
<td><strong>Update and Exchange facility</strong></td>
<td>non</td>
<td>non</td>
<td>import/export, document exchange</td>
<td>import/export, document exchange, object exchange</td>
</tr>
<tr>
<td><strong>Presentation facility</strong></td>
<td>MM presentation</td>
<td>MM presentation</td>
<td>improved quality synchronised MM presentation</td>
<td>HDTV quality synchronised MM presentation</td>
</tr>
<tr>
<td><strong>DBA facilities</strong></td>
<td>(only for the central database)</td>
<td>all</td>
<td>all</td>
<td>all</td>
</tr>
<tr>
<td><strong>MM coding</strong></td>
<td>MPEG1, JPEG</td>
<td>MPEG1, JPEG</td>
<td>MPEG2, JPEG, MM document standard</td>
<td>JPEG, MPEG2, MM document standard, MM objects coding standard</td>
</tr>
</tbody>
</table>

Table 4. Overview of four scenarios for a VM service and their likely retrieval approach and facilities.

### 3.9.6. Discussion

In the foregoing paragraphs an overview is given of a VM service, that includes a variety of MM applications which are able to meet a tremendous variety of customer specific needs. The main potential advantages for the types of actors involved are made clear. The technical bottlenecks, although often complex, do not seem invincible. Experiments and prototypes have shown that VM services are technically feasible (Hoogeveen & Andersson, 1993). The major bottlenecks are related to organisational and financial issues: how to set up a profitable information service? Which applications offer enough value added to be appealing to sufficient end users? How to be sure that a VM will give ROI for a service provider? In other words, short and medium term business viability is as yet, unclear. In the coming years, market pilots all over the world will be used to shed light on this issue.

One of the major financial bottlenecks is formed by the telecommunication costs. Over time, these costs will drop considerably, especially with the liberalising of communication markets. The main costs stem from the access network, because access network sharing is,
in most cases, limited to the members of a household. Sometimes low cost hybrid solutions can be found to circumvent some of the financial bottlenecks. Such hybrid solutions make use of the current copper based telecommunication infrastructure.
We presume that in the next decades, in most western countries, the necessary investments in the access network will be made to form a data highway. Then, the MM services of such a data highway will be the start of a real VM, and will probably boost innumerable new types of economic activities.

3.10. Summary

3.10.1. A corporate Marketing & Sales Support System

In the foregoing paragraphs several MRSs for M&S are presented and discussed. It is interesting to go one step further and to sketch, in summary, an overall picture to show the interconnections to be found between these MRSs. These MRSs must be viewed as subsystems of a corporate system.
The importance of having such an overall picture is that a commonly made mistake can be avoided, namely the mistake that ISs are developed with much enthusiasm without thinking about a growth path and embedding into the corporate (future) environment. A very important advantage of the overall picture is that the interfaces between the subsystems can eventually be identified and defined. Of course, it is hard to anticipate and forecast future developments, but should this be an excuse not to do it?
The overall picture of a corporate M&S system is given in figure 31. Three assistants or sales support systems for different sales outlets are grouped on the left side: the Shop Assistant to assist shop employees in consumer shops or business centres; the TSA system to support telesales employees; the MBC to support business sales personnel in general, or especially mobile personal sales. These three SSSs can be combined into one or two SSSs with more complex functionality. In practice, a trade off needs to be made between the advantages of having one or two generic systems and the advantages of having several custom made systems.
The SSSs can be used by the diverse sales people or directly by customers.
The ISPE (see section 3.9), the environment or group of environments in which the information services are created and updated, is at the centre. The information services are the different SSSs, MAI applications, MPSs, and VM information services. Corporate catalogue editors, news letter editors, database administrators, and many others involved in information production and maintenance are responsible for information service production. External suppliers like audio-visual producers, teachers, advertising agencies and system developers contribute directly or indirectly to information service production. The MCA and corporate assortment databases are important sources for the ISPE.
As can be seen in figure 31 the MDA has few connections with the other systems, as it is focused on internal marketing document flows.
Figure 31. Overall picture of a corporate M&S support system.

The importance of having an overall picture of a corporate M&S support system is that, in an early stage of the life cycle of MRSs for M&S, the interfaces between the subsystems can be defined, and common information coding and document structuring standards can be adopted to foster unhampered exchange of M&S data later on. Sharing of production facilities and information sources has synergetic effects.

A corporate M&S support system with the sketched complexity will only be useful for firms of a certain size. A limitation of such an overall concept is that it is yet rather uncertain if the concept will be adopted in this form. So, the concept needs to be considered continuously.

3.10.2. Indications of the viability and the business objectives and success/risk factors per system

In the introduction of this chapter we asked the question what potential viable MRSs for M&S can we distinguish on the basis of practical examples or as extrapolations of developments in M&S, multimedia systems and retrieval engines?. A number of alternative, more or less complementary, MRSs are presented, extensions on these systems are anticipated, and their mutual relations are discussed in an overall system.
The Viability of Multimedia Retrieval Systems for Marketing and Sales

The MRSs seem representative for MR developments within larger M&S firms, although permutations in business functions, system elements and retrieval facilities may lead to innumerable variations on the MRS themes.

Are these systems potential viable? All of the MRSs described are feasible with current technology. Nevertheless, there are still some important technical bottlenecks which need to be coped with:

- the price/performance ratio of MM transmission is a bottleneck that will only gradually disappear;
- the lack of standardisation and sometimes too little market acceptance of standards (de jure or de facto) is a bottleneck for system implementations.

A number of the MRSs for M&S discussed seem viable if we take into account that some implementations of these systems are already operational, and are accepted by the management and users involved. This is the case for the IECT photo archive (MCA), the TSA system, the MPS, and MAI systems. To gain more insight into the viability of MRSs for M&S it seems necessary to measure to what degree stated business objectives are met. Only in a very few cases are IT evaluation methods used, and when an IT evaluation method is used it is a cost benefit analysis. In most cases system effectiveness (or IT) evaluations are performed in qualitative terms, not in quantitative. It is interesting to remark that management decisions with regard to the implementation of MRSs are as a result based on qualitative observations rather than quantitative measurements.

The business objectives and perceived success/risk factors are summarised per system in table 5.
<table>
<thead>
<tr>
<th>System</th>
<th>Business objectives</th>
<th>Noted success/risk factors for implementations</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCA</td>
<td>• Saving costs</td>
<td>• Strong management commitment</td>
</tr>
<tr>
<td></td>
<td>• Improve the accessibility of photographs</td>
<td>• No quantitative insight into business value added</td>
</tr>
<tr>
<td></td>
<td>• Implement quality control</td>
<td>• Little IT knowledge</td>
</tr>
<tr>
<td></td>
<td>• Increased management control</td>
<td>• Not enough preparation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Too limited review of implementation alternatives</td>
</tr>
<tr>
<td>TSA system</td>
<td>• Improve quality of service to consumers</td>
<td>• Strong management commitment</td>
</tr>
<tr>
<td></td>
<td>• Increase productivity</td>
<td>• High involvement of users</td>
</tr>
<tr>
<td></td>
<td>• Improve knowledge level of telesales employees</td>
<td>• No measurement (yet) of business value added</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Unfamiliarity with MT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Integration with corporate IT infrastructure</td>
</tr>
<tr>
<td>MBC</td>
<td>• Quality of the catalogue as sales support tool</td>
<td>• Easy-to-use retrieval interface</td>
</tr>
<tr>
<td></td>
<td>• Streamlining internal information provision</td>
<td>• Rise of IT management costs</td>
</tr>
<tr>
<td></td>
<td>• Efficiency and improved customer relations if direct ordering is implemented</td>
<td>• Lack of insight into system effectiveness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Availability of MM expertise</td>
</tr>
<tr>
<td>MPS</td>
<td>• Making a (brand) name</td>
<td>• Quality of presentation</td>
</tr>
<tr>
<td></td>
<td>• Creating an innovative image</td>
<td>• The innovative impression</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Level of interactivity/gaming which leads to customer involvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Evoking enthusiasm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Insight in effectiveness of promotion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Self help aspect of customers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Time pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lack of IT expertise</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Unstable technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Price/performance ratio of promotion developers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Grip on system development process</td>
</tr>
<tr>
<td>MAI</td>
<td>• Reduced training costs</td>
<td>• Communication/reality value of training material</td>
</tr>
<tr>
<td></td>
<td>• Increased training effectiveness</td>
<td>• Integration with IT infrastructures</td>
</tr>
<tr>
<td></td>
<td>• Improved sales support</td>
<td>• Distribution and updating of courseware</td>
</tr>
<tr>
<td></td>
<td>• Improved customer support</td>
<td>• ROI estimates</td>
</tr>
<tr>
<td></td>
<td>• Increased productivity of instruction centre/reduce waiting times for trainees.</td>
<td>• Insight in MAI effectiveness</td>
</tr>
<tr>
<td></td>
<td>• Improved internal promotion</td>
<td>• Lack of retrieval expertise</td>
</tr>
</tbody>
</table>
### Table 5. Summary table business objectives, and success and risk factors.

<table>
<thead>
<tr>
<th>System</th>
<th>Business objectives</th>
<th>Noted success/risk factors for implementations</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDA</td>
<td>• More efficient archive management</td>
<td>• Integration with IT infrastructures</td>
</tr>
<tr>
<td></td>
<td>• Improved document processing support</td>
<td>• Implementation costs (incl. organisational costs)</td>
</tr>
<tr>
<td></td>
<td>• Improved management insight</td>
<td></td>
</tr>
<tr>
<td>VM service</td>
<td>• Reduction of purchase costs</td>
<td>• Costs of terminal equipment and communication</td>
</tr>
<tr>
<td></td>
<td>• Improved quality of service/meeting new demands</td>
<td>• (Insight in) business value added of information services</td>
</tr>
<tr>
<td></td>
<td>• Increased sales volume for IPs</td>
<td>• Usability of VM service</td>
</tr>
<tr>
<td></td>
<td>• Information about customer behaviour for IPs</td>
<td>• Copyright protection</td>
</tr>
<tr>
<td></td>
<td>• Direct access to markets and customers for IPs</td>
<td>• Lack of MM publishing and services experience</td>
</tr>
<tr>
<td></td>
<td>• Reduced sales outlet costs for IPs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Acceptable ROI for investing IPs, SPs, NPs, FPs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Generating more network traffic for NPs</td>
<td></td>
</tr>
</tbody>
</table>
Chapter 4

Hypotheses about the Viability of Multimedia Retrieval Systems for Marketing and Sales

4.1. Introduction

The central question in this chapter is: what hypotheses can be formulated about the viability of Multimedia Retrieval Systems (MRSs) for Marketing & Sales (M&S)? Viability is defined here as the state of being able to survive under business conditions. As argued in the introduction, the hypotheses should manifest the ideas, convictions and experiences that Multimedia Retrieval (MR) developers share with regard to the viability, and the variables influencing the viability, of MRSs for M&S. Such a set of related hypotheses is called a theory. As discussed in chapter 1, the term theory is used in the sense of 'grounded theory', and the value of such a theory is that:

• it gives insight into the viability and the factors influencing the viability of MRSs for M&S;
• it makes the hypotheses visible and thus testable;
• its constituent set of hypotheses (insofar confirmed) can be used cautiously as guiding-principles when developing MRSs for M&S.

The experiences with MRSs for M&S, presented in the previous chapter, are used here, together with a survey of business objectives and success/risk factors, to give a more systematic overview of factors influencing the viability of these systems. In the following sections, I start by explaining the symbols used to represent the hypotheses graphically and discuss my theoretic viewpoints, next I discuss the assumptions and outline of the theory, and in the following sections the outline of this theory is used to elaborate and group hypotheses about the value added of MR, success/risk factors, and MRS effectiveness\(^{29}\) in terms of meeting business objectives. Finally, as an upbeat to chapter 5

\(^{29}\)Effectiveness is the degree to which objectives are met. In the present case this means the degree to which M&S business objectives are met by using an MRS.
on testing hypotheses, the operationalisation of the dependent variables is discussed and the hypotheses are summarised.

4.2. Explaining the symbols used

Before formulating hypotheses as part of a theory it is necessary to explain the meaning of the symbols used in the simplified graphic representations of the hypotheses and theories. Figure 32 gives an overview of the graphic elements of a hypothesis or theory. A hypothesis or theory can be represented by variables, theoretic constructs, and the relationships between these variables. The relationships, represented graphically by an arrow, indicate which variables influence or cause effects on other variables. A relation value indicates whether the relationship is positive or negative. Eventually a correlation coefficient can be used to indicate the strength of the relationship.

![Graphic elements of a hypothesis or theory](image)

- **<variable>** A variable or theoretic construct. Depending on its position it is an independent or dependent variable.
- **<value>** Relationship between two variables. A relationship has a direction and has a value (+ = positive correlation; - = negative correlation; an eventual value between 0 and 1 is the correlation coefficient).
- **X** A special variable type is the interaction between a number of variables.

Figure 32. Graphic elements of a hypothesis or theory.

A variable is an independent variable in a relationship between variables if it is the influencing variable. Independent variables are found at the start of an arrow. A variable is a dependent variable in a relationship between variables if it is the influenced variable. Dependent variables are pointed at by an arrow. (Variables can be simultaneously independent and dependent since variables are always part of a variable chain).
Figure 33. A general, graphic representation of a hypothesis or simple theory and an example.

In the example given in figure 33, a hypothesis or simple theory is shown that states that the introduction of multimedia (MM) tele-ordering has a positive effect on sales volume.

4.3. Theoretic viewpoints

Before discussing the theory and hypotheses related to the viability issue, I first want to clarify my theoretic viewpoints. This is done on the basis of the three dimensions of theoretical structure proposed by Markus & Robey (1988): beliefs with regard to causal agency, logical formulation of the theoretical argument and level of analysis.

Markus & Robey, in their discussion of theories on IT and organisational change, notice three beliefs with regard to causal agency: external forces cause change (the technological imperative), people act purposeful to accomplish intended objectives (the organisational imperative) or change emerges from the interaction of people and events (the emergent perspective). The emergent perspective holds that the uses and consequences of information technology (IT) emerge unpredictably from complex social interactions.

I agree with these three beliefs to some degree. First, the technological imperative is reflected in the assumption that adding MR functionality leads to changes in the effectiveness of M&S Support Systems. Second, the organisational imperative is reflected in my belief that people act purposeful during a system development project to deliver a system that is effective in terms of meeting business objectives. Third, the emergent perspective is reflected in my belief that a system with a certain level of effectiveness emerges from the interaction between several variables in a system development process, the outcome of which is not really predictable.

Markus & Robey's (1988) second dimension of theoretical structure concerns the logical formulation of the theoretical argument. They adopt Mohr's distinction between variance and process theories. In a variance theory the precursor (the antecedent, independent variable or 'cause') is posited as a necessary and sufficient condition for the outcome (the effect, the dependent variable). In other words, a causal relationship between the precursor and the outcome is assumed in a variance theory. In process theories, however, the precursor is assumed to be insufficient to 'cause' the outcome, but is held to be merely necessary for it to occur, i.e., only a concomitant relationship between precursor and
outcome is assumed. The theory presented further on must be viewed as a process theory, as it is based on the observation that no guarantee can be given that an MRS will be viable, however 'ideal' the MR technology that is used seems and however 'ideal' the system development project is performed that results in the MRS, i.e., the precursor is not a sufficient condition.

Markus & Robey's (1988) third dimension of theoretical structure is related to level of analysis. They distinguish between macro level, society, interorganisational; micro level, individual; and mixed level analysis. Sol (1992) also gives the meso level, organisational. My theoretic viewpoint is most akin to the mixed level of analysis since I assume dynamic interplay between individuals, technology, and larger social structures to explain the value added of MR in relation to the viability of MRSs for M&S.

4.4. Basic assumptions and outline of the theory

The basic assumptions and outline of the theory, used in the following sections to formulate and group hypotheses, are discussed in this section. The structure of the theory presented can probably be generalised to other application domains, but this issue is not discussed here.

As already mentioned I adopt a process theory viewpoint: it is my firm belief that, as is the case with all system development projects, implementing an MRS for M&S can easily be a failure, but it requires tremendous effort, creativity, and knowledge to make it a success. Thus, in no way will implementing MRSs lead to guaranteed successes. There do, however, seem to be a number of variables that appear to influence the viability of MRSs for M&S.

The relationships between these variables are given in figure 34.

![Diagram](image)

Figure 34. Graphic outline of the theory of the viability of MRSs for M&S.

The viability of MRSs for M&S depends directly on the perceived effectiveness for the parties involved of an MRS for M&S. The viability depends indirectly on the actual effectiveness of the MRS for M&S in terms of meeting M&S business objectives. The effectiveness of the MRS, and thus indirectly the viability of the MRS, depends on the way
with which one is able to benefit from added MR functionality, and to cope with typical success/risk factors.
A number of assumptions can be found in these statements, these are formulated more precisely and reviewed in some more detail below.

A1. The degree to which MRSs for M&S are perceived as effective, *perceived system effectiveness*, by involved parties\(^{30}\) has a positive relationship with and direct influence on the viability, the state of being able to survive under business conditions, of these systems.

The perceived system effectiveness is the decisive variable with regard to the viability of MRSs. After all, perceptions about the effectiveness of an MRS in meeting its business objectives, determine whether a principal decides to proceed with the system development process or not.

A2. Perceived system effectiveness is positively related to actual *system effectiveness*, i.e., the degree to which an MRS can meet its M&S business objectives. The relationship is bi-directional: positive perceptions about system effectiveness influence actual effectiveness, and *vice versa*, observations and measurements of a system's actual effectiveness influence the perceived system effectiveness.

In other words, system viability depends indirectly on actual system effectiveness. In fact, we can observe that there is in most cases a large gap between perceived and actual system effectiveness. Even if system effectiveness measurements or calculations *are* performed this gap is still present, though perhaps smaller; it often is the qualitative interpretation and weighing of costs and benefits that forms the basis of perceptions about system effectiveness.

On the basis of the first two assumptions it can be hypothesised that an MRS for M&S is probably viable when a system meets significant business objectives effectively and is perceived as such by the involved parties. A number of observations support this hypothesis.

Decisions on implementing and accepting an MRS for M&S are often not based on structured and formal effectiveness measurements (see chapter 3), but are instead based on informal and unstructured observations. Often the enthusiastic responses of involved people are highly responsible for the acceptance of a system, and negative perceptions can be a tremendous and decisive threat to system viability. Disincentives for structured and formal effectiveness measurements tests are: lack of knowledge with regard to setting up tests, the cost and effort of setting up tests, justified doubts with regard to the validity and reliability of quasi-experimental tests, and even sometimes avoiding bad test outcomes.

\(^{30}\) The involved parties are the user groups, the support staff and the (representatives of the) principal.
Complicately for effectiveness measurement, is the fact that business processes are very complex, multifactor, socio-economic processes, which are as dynamic and little predictable as other socio-economic processes. It is very hard to isolate the effects of a specific independent variable in complex socio-economic business environments, business systems are in fact open systems. So, the outcomes of formal effectiveness measurements of business systems should, in most cases, be seen as effectiveness indications.

A3. Further, it is assumed that the presence or absence of success/risk factors influences system effectiveness and perceived system effectiveness and thus system viability, and that project management success/risk factors and system success/risk can be distinguished.

The better success/risk factors are dealt with during a system development project, the higher the quality of the project, the better the resulting system effectiveness, the more optimistic are perceptions, and the higher the potential system viability. System success/risk factors are aspects of an MRS that are critical for effectiveness and thus the viability of the system. Project management success/risk factors are contextual factors that influence the success with which an MRS development project is carried out.

Two examples can be given based on the summarised experiences in chapter 3. First, an example of a system success/risk factor: if an MM Business Catalogue (MBC) is not equipped with an easy to use user interface, sales people and customers will probably avoid using the MBC. As a consequence the system will not be effective as a sales support tool and will not prove viable. Second, an example of a project management success/risk factor: if there is little familiarity with MM Technology (MT) within an organisation it is necessary to hire expertise to cope with specific MT problems and opportunities; if insufficient expertise is hired all kinds of design mistakes and technical problems may result.

A4. Adding MR functionality has a positive influence on both system effectiveness and perceived system effectiveness.

This last assumption brings us to the core of this thesis, namely the idea that MR functionality has value added for MRSs for M&S. This aspect is elaborated in the next section.

4.5. Hypotheses about the value added of MR functionality

On the basis of A4 it can be hypothesised that MR has value added for M&S Support Systems. I consider the value added of MR to be based on the value added of MM, the value added of retrieval and a synergetic combination of both.

In literature and MR projects one can recognise a set of convictions, based on observations and experimental findings, with regard to this value added which is described below in the form of a combination of two paradigms: the multimedia paradigm and the retrieval
paradigm. The word 'paradigm' stresses the aspect of widespread, underlying convictions which often take the form of a firm belief, rather than just a set of testable hypotheses. This is particularly the case with multimedia.

4.5.1. Multimedia paradigm

The multimedia paradigm is the dominant conviction that adding MM functionality to information systems (ISs) leads to improved information and knowledge transfer to people. In other words, the MM paradigm is about the vision of computers as effective "tools for the mind" (Marmolin, 1991). Rich communication (multimediality), a high level of interactivity\(^{31}\), a high level of congruence of used information types\(^{32}\), an adequate usage of reference models (e.g., by data visualisation), and an adequate quality of represented information are presumed to contribute, via a number of interactions, to the improved information and knowledge transfer (see figure 35).

![Diagram](image)

**Figure 35. Cognitive model for the value added of MM.**

The interaction of independent MM variables, depicted at the left side of figure 35, leads to psychological responses:

- a high level of stimulation of the senses, at least with regard to the auditory and visual perception systems;

\(^{31}\)A high level of interactivity is not new, but present in many computer systems. A high level of interactivity is, however, new for audio and video systems, for example the TV.

\(^{32}\)The degree to which multiple information types are used to express the same ideas, to convey the same message.
• a high level of involvement, attention, concentration;
• emotional arousal\textsuperscript{33}, e.g., fun;
• strong recognition effects, using mental reference models.

These psychological responses interact in a complex way so that they give people the feeling they experience information instead of acquire it. The impact of MM messages is assumed to be high in comparison to non-multimedia messages by conventional marketing media and ISs, and thus lead to a hypothesised improved transfer of information and knowledge to people.

Yet, MM is not 'ideal' in many cases. Incorrect use of the MM elements can:
• result in negative cognitive side effects (e.g., overstimulation, cognitive overload, distraction, fatigue (Heller, 1990)) and
• thus reduce the effectiveness and efficiency of MM information and knowledge transfer.

It is believed that if one carefully avoids these negative cognitive side effects, MM improves:
• learning (retention, understanding, knowledge acquisition);
• the user friendliness of user interfaces and thus man-machine interaction;
• the entertainment value of systems (i.e., more fun);
• the impact of (marketing) messages, e.g., during business presentations or commercials.

M&S is believed to profit from MM Systems (MSs) for these reasons. Improved learning is important in all situations in which M&S or their customers need to learn something. Improved retention of mark and product names is an important marketing issue, the degree of user-friendliness of information services offered to a private or business customer is an important quality of service issue for M&S organisations, and the entertainment value of systems is an important marketing issue for products for the home entertainment market. Multimedia Promotion Systems are often also enriched with entertainment elements to attract and hold the attention of users. The impact of marketing messages is also a clear marketing issue.

The hypothesised value added of MM for marketing can also be illustrated by mapping the effects of MM on Burnett's (1993) five steps in human information processing related to marketing, exposure, attention, perception, retention, and retrieval and application. MM exposure is a stimulus hypothesised to draw more attention, as it is fun, moves, and responds interactively to our behaviour and, as a consequence, has more perceptual impact than more conventional media. Next, MM is hypothesised to improve the retention of marketing messages. With regard to the retrieval of marketing messages and application in terms of purchasing behaviour, it is also expected that MSs have a positive effect.

To conclude, it seems reasonable to hypothesise that:

\textsuperscript{33}If I use the word arousal, it is in the psychophysiological sense of emotional, internal arousal, related to arousal of the nervous system (Lindsay & Norman, 1977).

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HI. MM has value added for M&S in situations where effective information and knowledge transfer is needed.

4.5.2. Support of the MM paradigm

In support of the MM paradigm are notions from Perceptual Psychology. Perception psychologist Gibson (MacNab, 1987; Marmolin, 1991) argues that our senses are constructed to handle the very complex flow of information in natural environments, and that our senses are not constructed to handle simple stimuli. Gibson argues further that we are not passive receivers of information. Instead, our perceptual system is characterised by the pick up of information and by the integration of activities in the different senses. Although these argument are directed at the experimental study of human perception they are also relevant to MM computing: ISs that need to support human information processing very effectively, should make full use of human perceptual and cognitive capabilities and therefore should represent natural information flows to users and offer support to process natural information flows. According to Marmolin (1991) complex, dynamic and integrated representations of information really are necessary to utilise all the capabilities of the mind. Schadé (1993) puts forward a neuropsychological explanation for the relationship between MM and learning. Schadé argues that our brains learn most from MM information flows. A story in pictures is picked up much faster and uses less memory capacity than a text story. According to modern research in cognition MM information makes better use of the brain by appealing to both the left and right hemispheres34 (see Marmolin, 1991; Schadé, 1993). Both language oriented representations and visual representations are necessary to utilise the cognitive capabilities of the mind.

A number of independent MM variables believed to have a psychological impact, are introduced in figure 35: the level of multimediaity, the level of man-machine interactivity, the level of congruence of information types used, the usage of reference models and the quality of representation.

34The left hemisphere of the brain is relatively strong at analytical, verbal and sequential approaches to problems. The right hemisphere is relatively more synthetical and holistic than our left hemisphere. More specific, our right hemisphere is relatively strong at drawing, complex problem solving requiring spatial insight, and recognition of complex visual and auditive patterns or forms. Our left hemisphere is relatively strong at calculating, writing, reading, and logical reasoning. Thus, our brain consists of two, relatively independent, problem solving systems, that are both addressed by MM information instead of the left hemisphere being predominantly stressed by text oriented information representations.
Level of multimediality

The level of multimediality can be operationalised in terms of the number of information types used. The assumptions expressed in figure 35 are that the higher the level of multimediality:

- the more stimulation of the senses;
- the more arousal;
- the higher the involvement;
- the stronger the recognition effects.

The idea is that with a high level of multimediality it is more easy, than with a low level of multimediality, to reach a certain 'perception mass' necessary for a conscious processing of information and effective information transfer.

A similar idea is expressed by the learning pyramid:

```
   text
  text + graphics
 text + graphics + audio
 text + graphics + audio + video
```

The idea is that the more information types are included in a course, the more effective the course will be. Many variations of such learning pyramids can be found in the literature, but the evidence is not given! Nevertheless, such pyramids are interesting to mention because they are in accordance with the multimedia paradigm formulated and they are often copied, hardly disputed, and often misused.

The same is the case for the effectiveness statements of the British Audio Visual Society, described by Hapeshi & Jones (1992). This society speculates that we remember:

- 10% of what we read
- 20% of what we hear
- 30% of what we see
- 50% of what we see and hear
- 80% of what we say
- 90% of what we say and do at the same time

The last two lines are beyond multimediality: they plead for interactivity, which is discussed in the following subsection.

Johansson, following the tradition of Gestalt Psychology, showed that our visual system is developed to handle continuously changing information rather than static pictures (Marmolin, 1991). This pleads in favour of the inclusion of time-based data, such as motion pictures. Faber et al. (1991) conducted several experiments to answer the question under which conditions information types combinations including motion pictures, have substantial advantages in comparison to information types combinations without motion pictures. They hypothesised that motion pictures are superior for learning conditions in
which spatial or temporal properties of motions must be learnt. With regard to criteria of efficiency, success and time required for successful learning, however, substantial superiority for motion picture presentations was found only with regard to learning a rather complex motion pattern, not for other learning tasks including simpler motion patterns.

In support of the learning, effective information transfer, hypothesis are the results of a study of Nicolson et al. (1991). Nicolson et al. studied the effectiveness of MM courseware for dyslectic children. The children were found to improve their spelling skills significantly by using the MM courseware. Alas, the experimental design of this study is weak as it did not include control groups. So, it is not possible to isolate experimentally the independent variables that were responsible for the learning effect. It would have been of interest to make comparisons with traditional courses for dyslectics.

With regard to user satisfaction, ease vs. strain, enjoyability vs. boredom, Faber et al. found that learning by motion pictures is significantly easier and more enjoyable than learning without motion pictures. Nicolson et al. (1990) also found that their subjects enjoyed multimedia courseware. These findings support the idea that MM leads to positive arousal, which contributes positively to learning attitude and motivation; stimulating learning motivation is often an objective in teaching situations. This idea is further supported by the observation that MM games, including audio and video, are eliciting a more enthusiastic responses from players, than non-MM predecessors.

The value added of MM in terms of office task performance is not incontestable. In a study Gale (1990) tried to determine the value added to an office system of incorporating audio and video. His study did not show any significant differences between group performance on an information dissemination task, a creative co-operation task and a meeting scheduling task under three conditions: data sharing only, data sharing plus audio, and data sharing plus audio and video. It should be noted, however, that these tasks did not have an audio-visual component. So, we can argue that adding audio and video for these performed tasks is luxury, not a necessity. A finding of Gale in support of the positive arousal (fun) assumption (see figure 35) is that the audio-visual communication was socially appreciated as positive, 'personal' and 'informal'.

So, in contrast to the MM paradigm it can be observed that a higher level of multimediality alone is not sufficient for a better task performance, only for some learning tasks is an effective information transfer noted. Results indicating that MM is fun and enjoyable are more consistent.

Level of man-machine interactivity

As Gibson argues (Marmolin, 1991): we do not hear, we listen; we do not see, we look around. This means that we are actively exploring our environments. The zapping behaviour of TV 'couch-potatoes' is a current expression of our need for perceptual exploration instead of just passively watching a TV program. One of the visions of MM, based on this argument, is that the user of an MS should be enabled to explore the natural MM information in an active way. Neither the author of the information nor the designer should decide how the information should be processed, the user should be in control.
I operationalise active exploration of the computer environment in terms of the level of man-machine interactivity. A low level of man-machine interactivity, e.g., only switch a presentation on or off, does not really support our explorative behaviour and will lead to less involvement than systems with a high level of man-machine interactivity, e.g., influence on the course of displayed events, manipulation of objects, and editing content data.

Schadé (1993) states that MM improves sensory stimulation, particularly due to the inclusion of interactivity. For example, he estimates that reading stimulates about 1% of the sensory capacity of the eye. TV watching stimulates about 25-30% of the eye. If depth (3D images) and interaction with visual objects is added 60% or more of our eye is stimulated. The interactive and gaming elements in addition stimulate motoric behaviour and thus the brain even more, e.g., for making choices or solving problems. The role of sensory stimulation for learning is unclear, but it is assumed by Schadé that a high level of sensory stimulation facilitates learning more than a low level.

Considering these arguments it seems reasonable to assume that the level of interactivity of an MS is an important variable with regard to the effectiveness of information transfer. Yet, we should be careful about drawing further conclusions since the validity of these arguments is unclear.

Level of congruence

The level of congruence is the degree to which different information types are used redundantly to express the same ideas. The basic assumption is that a high level of congruence of information types is far more effective than a low level of congruence for recognition and extending the mental reference models necessary for effective information transfer (learning).

Marmolin (1991) speaks of the redundant use of information sources. For example, the redundant use of colours has two effects. It facilitates the pick up and processing of information and it results in a more stimulating environment. This applies to the redundant use of sound. A study by Graver using sounding interfaces, where each event is characterised both visually and auditorily supports such a hypothesis (Marmolin, 1991).

Disruption is one of the negative cognitive side effects MSs may have if information types are used incongruently. In their review Hapeshi & Jones (1992) describe a number of studies that have demonstrated the attention grabbing, sometimes disrupting effect of audio, background speech, noise. Although sounds are generally thought to be useful to deliver warnings and for context switches, Alty et al. (1993) found opposite results. In their experiment subjects performed a process control task called 'the Crosman Waterbath' tasks. The Crosman Waterbath task involves the control of a simulated thermal hydraulic system that consists of a single tank. A valve on inflow and outflow pipes may be used to regulate the inflow and outflow. A heater, situated immediately underneath the tank, is the third control variable. In some experimental conditions sounds were used as warning signals, in others not. Alty et al. found in their experiment that such sounds have a detrimental effect on performance. It can be argued that the explanation for this is probably that the sounds were used incongruently with the other information, and thus led to disruptions.
With regard to the congruent use of synchronised video and audio Hapeshi & Jones remark that the presence of moving images can serve to enhance comprehension and learning of spoken material. As an example of this, they described an experiment of Hayes, Kelly & Mandel comparing the effectiveness of TV presentations to that of radio presentations of narrative information. Generally, the inclusion, during recall, of inaccurate story content and the distortion of actual story details occurred more often in the auditory only condition than in the aural and visual condition. Hapeshi & Jones further describe studies showing that the presence of an incongruent video presentation significantly reduces recognition memory of audio material, but that showing a congruent visual map results in better recall, particularly if the narrative structure is relatively simple. In the case of a monologue or a dialogue, visual display can facilitate processing of the auditory message if the speaker's face can be seen, because facial expressions, particularly lip movements enhance speech intelligibility. Visual display of text can also enhance speech intelligibility, e.g., to recognise the lyrics of a song. Another example is a study described by Hapeshi & Jones that shows that hearing a colour word improves the naming of a colour patch if the auditory word is congruent with the ink colour, i.e., hearing the word "red" when required to name aloud a red patch. All of this suggests, according to Hapeshi & Jones, that when the visual and auditory channels provide congruent messages, processing is easier.

Adequate usage of reference models

I postulate that an adequate usage of reference models in presented information stimulates recognition and transfer of information to people. A mental reference model is the meaningful organisation of information in our brains. Adequate usage of reference models means that we use, for example, meaningful sounds, pictures and movements to express ideas.

Schadé (1993) argues that if reference 'pictures' are added to text, people pick up and understand a story about 75% faster than if they are confronted with a text only story. Schadé hypothesises that by using reference models, innate or acquired in our early childhood, text and picture stories are stored faster and more efficiently in our long term memory than text-only stories. He states that people tend to remember 25-35% more of a text and pictures story than of a text only story.

The use of reference models is a well accepted marketing practice to use basic reference pictures and sounds to improve advertisements and commercials. Often family scenes, status symbols, attractive women and responsible men etc. are weaved into the marketing material. For these reasons, it seems reasonable to assume that adequate use of reference models is an important variable with regard to effective information transfer.

Quality of representation

The quality of the representation of information in an MS seems to be an important variable. A more realistic representation of information leads to more natural arousal (e.g., a realistic surgery film can invoke physical and mental distress and audio-visual computer games are more fun than character oriented games) more involvement (e.g., aesthetic representations
are used to attract attention) and better recognition. The recognition effect is illustrated by the study of Brooks et al. (1991). Brooks et al. examined, in an experimental study, whether additional information types added to a tutoring system would enhance effectiveness as measured by speed and accuracy of student performance. They also examined student opinions on the suitability of the system and its information types. Students received a tutorial incorporating either a) text and graphics, b) text, graphics and sound or c) text, photographs and sound. Significant differences were found between the test groups under conditions b and c. Group c performed better on a 'flower recognition' task and an 'object construction puzzle' task. For these tasks it is concluded that photographic representations were superior to simple graphic representations. We can conclude from this that a high quality of a (graphic) representation has a value added if the reality value of represented information is important for the performance of a task.

The importance of the quality of representations is also stressed by a number of classic experiments (Nielsen, 1990) with regard to reading efficiency in relation to text representation on paper and on screen. These comparative experiments indicate that subjects read 25-30% slower from computer screens than from paper and that these subjects also have significantly higher error rates. It is only possible to achieve the same reading speed when the computer screen was high-resolution and used anti-aliased proportional fonts. A side remark is that one can conclude from this that one should be careful with just replacing text books by electronic text books. In the case where one is using electronic text books using MM is probably necessary to compensate for the loss of readability of text information using the current generation of computer screens!

In general, it can be assumed that quality of information representation is an important MM variable for tasks including object recognition and/or reading.

4.5.3. Retrieval paradigm

The retrieval paradigm is the dominant conviction that all tasks or processes which include search and database management (sub)tasks will benefit from electronic retrieval systems. In the case of MM tasks and processes one can read 'MRS's instead of 'electronic retrieval systems'.

Little controversial is the idea that electronic retrieval mechanisms in comparison to manual retrieval improve:
- search efficiency (how much effort is needed to find what you want to find);
• search effectiveness (finding what you want to find in terms of precision and recall; see chapter 2);
• database management.
In addition, MR is believed to
• effectively support exploration using associative hyperlink mechanisms (e.g., explorative learning, exploring criminal relations, exploring ideas and structuring discussions);
• further improve search performance by a far better presentation of retrieved objects, e.g., in the form of Query By Visual browsing;
• improve database management by offering facilities to manage multimedia databases.
For example in the Tele Sales Assistant (TSA) system and MM Communication Archive (MCA) cases described in chapter 3 it is noted that Query By Visual browsing, in which a searcher selects or ignores retrieved database objects on the basis of associated pictures, is much more efficient and effective than query by text only interfaces (e.g., Query By Example).
When considering the effectiveness of retrieval systems it is important to take notice of the gaps that exist between:
• the actual information need and the formulation of that information need;
• the formulated information need and the formulated query;
• the formulated query and the result set.
The last two gaps are addressed by precision and recall surveys discussed in chapter 2.
In general, the use of computer systems improves search efficiency and search effectiveness, precision and recall, when searching through large databases in comparison to searching manually through databases.
It is a pity that the effectiveness of individual retrieval facilities in office situations is rarely addressed by research. On the basis of experiences with MRSs I hypothesise that:
• complex retrieval facilities, like inexact query languages, are useful only to specialist information workers;
• simple to use facilities are useful for all types of people working with an MRS on a regular basis;
• very simple, low threshold, facilities are useful for inexperienced, ad hoc, or handicapped users;
• MDBMSs are suited to be at the heart of most MRSs.
One of the retrieval facilities that is strongly investigated and has a strong theoretic basis with regard to its cognitive effects is hypertext and hypermedia. Hypertext representations may correspond with the mental associative knowledge representation in the mental reference models of a user. Within a hypertext document a user can trace associative references which correspond with associations with mental reference models in their memory. Discovering new hyperlinks stimulates the extension of these mental reference models. This is akin to Jonassen's (1989) concept of 'web learning', which assumes that information, when learned, is integrated with prior knowledge using a web structure rather than in a linear fashion.
Hyperlinking structures, however, are reported to have a number of negative cognitive side effects. The most important side effects are (Wolsjwijk & De Kleine-Noorbergen, 1992; Heller, 1990; Van der Meer, 1991):

- disorientation: it can happen that users become lost in a hypertext document;
- cognitive overload: too much choice overstrains the cognitive capacity of a user;
- inefficient searching: hypersearching is sometimes an inefficient way of searching purposefully.

Hypertext textbooks, i.e., textbooks in the form of hyperlinked text fragments, have not yet proven to be a more effective learning tool than sequential, conventional textbooks. One of the alternative explanations for this can be that the current generation of computer screens are less effective than paper as a presentation medium for text.

In conclusion, if we return to the retrieval paradigm discussed at the start of this section, the hypothesis on the impact of retrieval on M&S can be formulated as follows.

H2. Retrieval functionality has value added for M&S situations where search performance and database management performance are important.

4.6. Hypothesised success/risk factors

It can be derived from assumption A3 that to successfully conclude an MRS development project a number of success/risk factors must be coped with. Every success/risk factor alone is potentially sufficient to disqualify project results and threaten the viability of the MRS for M&S. As discussed, I see project management success/risk factors and system success/risk factors as clearly distinct classes of success/risk factors. In most cases these success/risk factors are also applicable to projects and information systems outside the scope of this thesis, but for MRSs for M&S certain important points of gravity can be made. For each and every MRS for M&S project, and for every type of MRS for M&S, a different set of success/risk factors is relevant to a different degree. It is interesting to hypothesise which project management and system success/risk factors are relevant for MRSs for M&S in general, though we must not see any list of such success/risk factors as fixed, as is the case with traditional IT critical success factors (Pollalis & Hanson Frieze, 1993).

In this section an overview is given of the two classes of success/risk factors hypothesised to be relevant. This overview is based on an n=19 survey of MM projects in which respondents were asked to give the business objectives relevant to their project (see section 4.7.), and the most relevant project management success/risk factors (this section) and system success/risk factors (this section). Most of the respondents were employees of PTT Telecom (7) and PTT Research (9), three came from organisations outside Royal PTT Nederland. Respondents working on projects discussed in chapter 3 were included in the survey to introduce experience with the MRSs under investigation. (See also appendix C). The objectives and success/risk factors mentioned were grouped on the basis of similarity. Next, the frequency with which mentioned objectives and success/risk factors were
attributed to a group was scored, to give the frequency for which success/risk factor groups were relevant for the respondents (more than one group may be relevant for a respondent).

**Project management success/risk factors**

In decreasing order of frequency the groups of project management success/risk factors are:

- availability of multidisciplinary expertise (74%);
- insight into target group (47%);
- organisational changes (47%);
- sufficient preparation (37%);
- development and implementation costs (32%);
- time pressure (26%);
- co-operation with other parties/partners (26%);
- insight into business value added (26%);
- system integration problems (21%);
- marketing of project results (16%);
- management commitment (16%);
- training of personnel (11%);
- flexible ways of system development (11%);
- testing the system (5%).

Factors related to the availability of multidisciplinary expertise were mentioned most often. The reason for this is probably that MM is still relatively new and requires, as an integration technology, diverse expertises that has not needed to be combined before. If this is true multidisciplinary expertise will become a less important factor over time as MM expertises become more available in the market, and the complexity of MM technology is further reduced by new technological improvements.

The availability of specific MM expertise was seen as indispensable. For example, being at the mercy of an inexperienced MM studio was seen as a tremendous risk for developing sound CD-i's. Specialist expertise is also needed for the selection of adequate retrieval mechanisms, this is relatively scarce if one wants to make use of advanced retrieval facilities.

Factors related to insight into target group were mentioned by about half of the respondents. MM project leaders having a focus on conquering a certain market with an MM product, an MM title for example, in particular stressed the importance of insight into target groups.

With regard to organisational changes it is interesting to note that enthusiasm is believed to be one of the success factors for invoking organisational change, and that MM is believed to help to evoke the enthusiasm of involved project members, principals and user groups: MM is seductive.

In about one third of the projects factors with regard to development and implementation costs were mentioned: too limited budget, high costs of developing MM information (shooting film), and the cost of settling copyrights.
Processing MM information requires the seamless co-operation of multiple types of media, therefore, MRSs, supporting this, are the outcome of a system integration process; system integration problems are typical for MRS projects. MR technology is evolving rapidly and, partly due to its newness, is often unstable. One effect is that during an MRS development process a number of undocumented bugs in software and hardware, and a number of interoperability problems can be encountered.

System success/risk factors

In decreasing order of frequency the mentioned groups of system success/risk factors are:
- integration with IT infrastructures (47%);
- ease of use (42%);
- flexible user support (37%);
- system and usage costs (32%);
- quality of information (32%);
- motivational system aspects (32%);
- image (21%);
- placing (11%);
- technical reliability (11%).

Integration with IT infrastructures is a topical issue related to MRSs. The first generation of MRSs was stand-alone. More and more projects aim at MRSs that are part of the corporate IT infrastructures. Over time, when integration with IT infrastructures becomes normal, this group of factors will probably cease to receive so much attention.

User-interface aspects or usability aspects were often mentioned (42%), which are related to the factor ease of use. Ease of use is of extreme importance for user acceptance and thus viability of a system. MM elements are often introduced to improve the ease of use, however, the use of multiple information types can also complicate the user-interface.

More than one third of the mentioned system factors are related to flexible user support. It is seen as important that MR technology introduces more functionality into ISs. This can improve the support of the different ways of working of different types of users, and human information processing. The flexibility of an MRS increases when it is able to support multiple types of users with multiple ways of working with multiple types of media.

High costs are a clear threat for the viability of any system, this was mentioned by one third of the respondents. MR end products for consumers need, especially, to be competitively priced, and affordable. The price of MR services depends heavily on the level of communication costs. These costs need to be reduced to make MR services affordable.

Factors related to quality of information were mentioned by about one third of the respondents, i.e., completeness and topicality of product databases, understandability of information presented to users, communication and presentation value of marketing information. Too poor quality of audio-visual data was seen, in one case, as a serious risk factor. In the case where instructions or an explanation of services is given to users the reality value of presented information is of extreme importance.
The motivational aspects of marketing media, and thus MRSs if they are used as a marketing medium, are of relevance for marketing. MM touches end users' emotions by congruent appeal to cognitive reference models and thus may motivate towards purchasing behaviour. That MM is appealing is seen as a success factor. Image aspects are mentioned by about 20% of the respondents. For example, in the case of the MM Promotion System (MPS; see chapter 3) the innovative image was seen as an important success factor.

**Success/risk factors and MRSs for M&S**

To what degree are the groups of factors, listed above, MM specific? I made a qualitative attempt to visualise differences with regard to the MRSs for M&S, presented in chapter 3, in the tables given below.

For example, the project management group of success/risk factors 'multidisciplinary expertise' is extremely relevant for MRSs where complex, multi-party MRSs are developed using relatively innovative, and therefore unstable, technology, e.g., a Virtual Market (VM) application; multidisciplinary expertise is also relevant for the other MRSs for M&S but not so highly relevant.

<table>
<thead>
<tr>
<th>MRS for M&amp;S</th>
<th>MCA</th>
<th>TSA</th>
<th>BSA</th>
<th>MPS</th>
<th>MAI</th>
<th>MDA</th>
<th>VM</th>
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</thead>
<tbody>
<tr>
<td>Multidisciplinary expertise</td>
<td>4</td>
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<td>4</td>
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<td>4</td>
<td>5</td>
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<tr>
<td>Insight into target group</td>
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<tr>
<td>Development and implementation costs</td>
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<tr>
<td>Time pressure</td>
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<tr>
<td>Co-operation with other parties</td>
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<td>5</td>
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<tr>
<td>Insight into business value added</td>
<td>4</td>
<td>4</td>
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<td>5</td>
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<td>System integration problems</td>
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<td>Management commitment</td>
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<tr>
<td>Training of personnel</td>
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<tr>
<td>Flexible system development</td>
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<tr>
<td>Testing the system</td>
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<tr>
<td>Mean</td>
<td>3.9</td>
<td>3.9</td>
<td>3.9</td>
<td>3.7</td>
<td>3.7</td>
<td>3.9</td>
<td>4.7</td>
</tr>
</tbody>
</table>

1. Highly irrelevant
2. Irrelevant
3. Sometimes relevant
4. Relevant
5. Highly relevant

Table 6. Relevance estimates of project management variables for MRSs for M&S.

The mean gives an indication of project difficulty.
For example, the group of system success/risk factors 'integration with IT infrastructures', is highly relevant for the VM, in which many different applications and the many public and private information systems need to co-operate; integration with IT infrastructures is not always relevant for an MPS or MM Assisted Instruction (MAI), which need not to be networked, and is just relevant for the other MRSs.

<table>
<thead>
<tr>
<th></th>
<th>MCA</th>
<th>TSA</th>
<th>BSA</th>
<th>MPS</th>
<th>MAI</th>
<th>MDA</th>
<th>VM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration with IT infrastructures</td>
<td>4</td>
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<td>3</td>
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<td>5</td>
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<tr>
<td>Ease of use</td>
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<tr>
<td>Flexible user support</td>
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<td>System and usage costs</td>
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<td>5</td>
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<tr>
<td>Quality of information</td>
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<td>Motivational system aspects</td>
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<td>Image</td>
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<tr>
<td>Placing</td>
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<td>4</td>
<td>4</td>
<td>5</td>
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<td>3</td>
<td>5</td>
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<tr>
<td>Technical reliability</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<td>3</td>
<td>5</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>3.8</strong></td>
<td><strong>4.0</strong></td>
<td><strong>4.0</strong></td>
<td><strong>4.3</strong></td>
<td><strong>4.3</strong></td>
<td><strong>3.7</strong></td>
<td><strong>5.0</strong></td>
</tr>
</tbody>
</table>

1 Highly irrelevant
2 Irrelevant
3 Sometimes relevant
4 Relevant
5 Highly relevant

Table 7. Relevance of system variables for MRSs for M&S. The mean gives an indication of system difficulty.

We can argue that if the relevance estimates of success/risk factors are relatively low the short term viability of a certain type of MRS is relatively high, and, *vice versa*, we can argue that if the relevance estimates of success/risk factors for a certain type of MRS are relatively high short term viability is relatively low. The latter is certainly the case for my estimations with regard to the VM, expressed in the high means. High investment, many uncertainties, technical complexity and large number of parties involved explains why teleservice providers are so cautious about setting up VM services.

On the basis of experiences with developing MRSs for M&S as described in the previous chapter and as incorporated in these estimations a hypothesis is formulated about the viability of MRSs for M&S.

**H3. All the MRSs for M&S are viable except for the VM which will become viable in the intermediate or long term future.**
With regard to the identified success/risk factors a fourth hypothesis is formulated, in which only MM specific success/risk factors are considered:

**H4. The MM specific project management and system success/risk factors are critical for the viability of MRSs for M&S.**

Some of the MM specific success/risk factors are: the availability of MM and MR expertise, the level of MM development costs, MR system integration bottlenecks, easy to use MM user interfaces, MM communication costs, quality of MM information, motivational effects using MM, and the innovative image of MM.

### 4.7. Business objectives hypothesised as relevant

As discussed, a basic hypothesis is that adding MR elements and facilities leads to an improved system effectiveness in terms of meeting business objectives. In this section an overview is given of business objectives hypothesised to be relevant for MRS for M&S based on the n=19 survey described in section 4.6.

Before discussing the grouped business objectives I want to stress that the grouping of business objectives is designed to highlight the business objectives that are seen as important for MRSs for M&S. Any grouping of business objectives should be seen as dynamic since business objectives vary with time, from case to case, from firm to firm, and from culture to culture.

Therefore I did not strive for a complete list, the sample was too small for that, however, the list appears to be representative in the sense that the most important business objectives are mentioned, although the grouping is somewhat arbitrary.

In decreasing order of frequency, the mentioned groups of business objectives are:

- improving a market position (84%);
- improving quality of service (63%);
- improving promotion (32%);
- efficiency gains (32%);
- improved productivity (26%);
- improved information and knowledge transfer (21%);
- increased management control (11%).

Since, MR services are in their infancy 'improving market position' is seen as a business objective in almost all MM projects surveyed; improving market position is the most often mentioned group; for example by exploring market opportunities for MM services or extending market positions in a growth market. Examples of entering a new market are the selling of exposure on MM Points of Sale and the publishing of CD-ROMs and CD-i's. As MSs become more common, the attention given to exploring market opportunities will probably decrease.

MRSs are sometimes seen as a weapon to defend an old market position by improving competitiveness, by delivering better services, and by lowering sales costs.
MM was seen as an opportunity to improve the quality of service by about two thirds of the respondents, for example, by offering around the clock services by touch screen interfaces on a shop-window at night or by user-friendly shopping systems at home. Another example is that the quality of customer support is believed to improve with the use of MM catalogues instead of dull paper catalogues.

Improving promotion is a typical MM business objective, mentioned by about one third of the respondents. Improving corporate image is a PR objective that was sometimes mentioned. MM means were seen as useful for improving corporate communication. MRSs are, in several cases, used (see also the previous chapter) to make a (brand) name, which means improving name retention. It is believed that manufacturers of consumer products will be better able to communicate their unique selling position using MRSs.

The objectives related to improving information and knowledge transfer, mentioned by about 20% of the respondents, are in compliance with the multimedia paradigm discussed. Examples of this are improved training effectiveness and the resulting improved knowledge level of sales personnel.

To what degree are the business objectives discussed above MM specific? Again, a qualitative attempt is made by me, in the table below, to visualise differences with regard to the MRSs for M&S presented in chapter 3.

<table>
<thead>
<tr>
<th>MRS for M&amp;S</th>
<th>MCA</th>
<th>TSA</th>
<th>MBC</th>
<th>MPS</th>
<th>MAI</th>
<th>MDA</th>
<th>VM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving a market position</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Improving quality of service</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Improving promotion</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Efficiency gains</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Productivity</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Improved information/knowledge transfer</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Increased management insight</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Mean</td>
<td>3.9</td>
<td>3.9</td>
<td>3.9</td>
<td>3.9</td>
<td>3.9</td>
<td>3.4</td>
<td>4.6</td>
</tr>
</tbody>
</table>

1. Highly irrelevant
2. Irrelevant
3. Sometimes relevant
4. Relevant
5. Highly relevant

Table 8. Relevance of business objectives of MRSs for M&S. The mean gives an indication of ambition level in relation to objectives relevant to MM projects.

For example, improving a market position is the main, and thus a highly relevant, objective of MPSs and for many VM applications; improving a market position is also relevant for the TSA, and MBC, but archives (MCA and Marketing Documentation Archive (MDA))

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and training (MAI) are, from the viewpoint of an M&S firm, not primarily directed at improving a market position.

On the basis of the grouped M&S business objectives a number of hypotheses with regard to the effectiveness of MRSs for M&S can be derived, graphically depicted in the figure below. These hypotheses can be reformulated in one sentence:

**H5. MRSs for M&S are (perceived to be) effective in terms of meeting M&S business objectives, which are related to one or more of the variables: market position, quality of service, promotion, M&S efficiency, M&S productivity, M&S information and knowledge transfer and management insight.**

![Diagram](image)

Figure 36. Graphic overview of hypotheses with regard to the effectiveness of MRSs for M&S in terms of meeting business objectives.

With regard to the relevance estimates we can argue that a higher mean relevance estimate corresponds with a more ambitious MRS, this is clearly the case with the VM.
4.8. Operationalisation of the dependent variables

Three dependent variables are presented in figure 34, effectiveness, perceived effectiveness and viability of MRSs for M&S. The operationalisation of these variables is discussed here. In their quest for the dependent variable to measure Information Systems success based on an extensive literature survey, DeLone & McLean (1992) classify the operationalisations (empirical measures) of IS success into six categories, which they relate to the classifications of Shannon and Weaver, and Mason. The first three categories are adopted by Delen et al. (1991) in their product quality framework. DeLone & McLean's success categories are categories of empirical measures of:

- **system quality**, i.e., measurements on a technical level according to Shannon and Weaver and production level according to Mason, like response time, flexibility of system, system reliability and system accessibility;
- **information quality**, i.e., measurements on a semantic level according to Shannon and Weaver and product level according to Mason, like accuracy, completeness, conciseness, relevance, timeliness, and understandability.
- **information systems use**, i.e., measurements on the receipt level according to Mason (Shannon and Weaver use the broader term effectiveness or influence level), like percentage of time an IS is used, frequency of use, number of functions used, use of numerical vs. non numerical data.
- **user satisfaction**, i.e., measurements on the recipient response to the use of the output of an IS (not distinguished by Shannon and Weaver from their effectiveness/influence level or by Mason from his influence on recipient level), like overall user satisfaction, user information satisfaction, enjoyment, top management satisfaction, software satisfaction, and hardware satisfaction.
- **individual impact**, i.e., measurements on the effect of information on the behaviour of the recipient (not distinguished by Shannon and Weaver or Mason), like time taken to complete a task, decision quality, time to decision, time to solve a problem, user understanding, quality of plans, and personal productivity.
- **organisational impact**, i.e., measurements on the effect of information on organisational performance (not distinguished by Shannon and Weaver or Mason), like profit performance, innovations, cost-benefit ratio, and Return On Investment.

In the outline of the theory, presented in figure 34, we can match the construct system effectiveness (in terms of meeting business objectives) with the individual and organisational impact categories of DeLone & McLean. We can relate user satisfaction to the perception construct, which appears to be an important predictor for system viability. Information systems use may be an operationalisation of system viability in terms of user acceptance. System viability can also be operationalised as past, current and future market acceptance. DeLone & McLean's system quality and information quality are integral elements of the system effectiveness construct insofar system quality and information quality is defined in terms of meeting certain business objectives, like quality standards, etc.
To conclude this section, we can operationalise the dependent variable *viability of MRS for M&S* as:
- information systems use: the more frequent, and intense and the longer an implementation of a system is used, the more viable it is;
- market acceptance: the more a system is (going to be) accepted, the more viable it is;
- technical feasibility: only then when a system can be implemented, it is potentially viable;
- expert perception of viability: experts perceptions about the viability of a system is an accepted measure of the actual viability, although not completely valid and reliable.

When we consider system effectiveness in terms of meeting business objectives and the perceptions about system effectiveness as important predictors for system viability, we can take these constructs as dependent variables. *System effectiveness* can be operationalised as:
- individual impact: i.e., the degree to which an MRS for M&S is effective in meeting business objectives in terms of tasks of individuals;
- organisational impact: i.e., the degree to which an MRS for M&S is effective in meeting business objectives in terms of organisational performance;
- system and information quality: the degree to which MM information and MR functionality have value added.

System effectiveness can be measured using IT evaluation techniques such as those discussed by Farbey et al. (1992). When applying an IT evaluation technique we should be conscious of its limitations, the validity of IT evaluation techniques is a matter of concern. *Perceived system effectiveness* can be operationalised as:
- user satisfaction: the degree to which user groups in the broadest sense are satisfied with the implementation of an MRS;
- perceptions about meeting business objectives: the degree to which expert groups, managers with the power of decision, and other non-user groups, see the (implementations of) MRSs for M&S as effective for meeting certain previously defined business objectives.
- perceptions about the value added of the MRS: the degree to which it is believed by experts, managers etc. that the MRS has value added in term of meeting certain objectives not met before.

The latter two points are firmly related, and are merely a reformulation of each other.

### 4.9. Summary

An overview of the hypotheses with regard to the viability, and the factors influencing the viability, of MRSs for M&S is given in this chapter.

It is assumed that the viability of MRSs for M&S depends directly on the effectiveness perceived by involved parties of an MRS for M&S. It is assumed further that viability depends indirectly on the actual effectiveness of an MRS for M&S in terms of meeting M&S business objectives. Finally, it is assumed that the effectiveness of an MRS for M&S, and thus indirectly the viability of an MRS, depends on the way in which one is able to
benefit from the added MR functionality, and one is able to cope with typical success/risk factors.

The value added of MR is explained by the MM paradigm, a cognitive model for the value added of MM, and the retrieval paradigm. Research findings tend to confirm that MM has a certain value added for information and knowledge transfer (learning) although negative cognitive side effects of MM and retrieval, e.g., hypertext, may inhibit positive learning effects. Research findings have further made clear that the MM paradigm is too optimistic: an MS is not a panacea; just adding MM functionality does not necessarily leads to better performance of office tasks.

Finally, a first step is made towards operationalising the dependent variables: system viability, system effectiveness and perceived system effectiveness.

The five main hypotheses are summarised below.

**H1. MM has value added for M&S in situations where effective information and knowledge transfer is needed.**

To realise this value added of MM, the information conveyed needs to make adequate use of interactivity, information types should be used congruently, the way the information is presented should be of a suitable quality and adequate use of reference models should be made.

The level of multimediality rises with the adding of non-textual information types, like stills, graphics, audio and video, to textual information.

**H2. Retrieval functionality has value added for M&S situations where search performance and database management performance are important.**

To realise search performance benefits, adequate use of retrieval facilities should be made. Complex retrieval interfaces can only be provided for retrieval specialists. Query By Visual browsing is probably an effective retrieval means for non-retrieval specialists.

**H3. All MRSs for M&S are viable except for the VM which will become viable in the intermediate or long term future.**

Viability aspects can be operationalised as information systems use, market acceptance, technical feasibility and expert perception of viability. With regard to information systems use, the frequency, intensity and duration of use are three viability dimensions.

**H4. The MM specific project management and system success/risk factors are critical for the viability of MRSs for M&S.**
Some of the MM specific success/risk factors are: availability of MM and MR expertise, level of MM development costs, MR system integration bottlenecks, easy to use MM user interfaces, MM communication costs, quality of MM information, motivational effects of using MM, and the innovative image of MM.

$H5. \text{MRSs for } M&S \text{ are (perceived to be) effective in terms of meeting } M&S \text{ business objectives, related to the variables: market position, quality of service, promotion, } M&S \text{ efficiency, } M&S \text{ productivity, } M&S \text{ information and knowledge transfer and management insight.}$

Perceived system effectiveness is assumed ($A_1$) to be positively related to system viability. Perceived system effectiveness can be operationalised as user satisfaction and perceptions about meeting business objectives. System effectiveness can be operationalised in terms of meeting M&S business objectives related to tasks of an individual, organisational processes and system and information quality. The effectiveness of MRSs for M&S can be measured using IT evaluation techniques.
Chapter 5

Testing Hypotheses

5.1. Introduction

This chapter describes a number of expert assessments, and Cost Benefit Analyses (CBAs) to answer the subquestion, what support can be found for hypotheses about the viability of Multimedia Retrieval Systems (MRSs) for Marketing & Sales (M&S)?

This chapter has two parts in which the five hypotheses, described in the previous chapter, are tested.

The first part contains expert assessments of the value added of MM and the relevance of success/risk factors, the viability of seven clusters of MM teleservices, and the viability of a Multimedia Business Catalogue (MBC) and a promotional CD-i. Thereafter, the results of a survey of potential investors in MM teleshop services are given. Next, marketing research is reviewed to assess the economic viability of MRSs for M&S.

The second part contains a retrospective CBA and ROI computation of the IECT photo archive, making a case for the effectiveness and economic viability of an MCA, and a prospective CBA and ROI computation of an MBC for tele-ordering by Top 1000 accounts, giving an indication of the effectiveness and economic viability of an MBC for tele-ordering.

Finally, the findings are summarised.

5.2. Test measurement, test reliability and test validity

Since the first part of this chapter is about testing statistical hypotheses using questionnaires for surveys and expert assessments, it is important to look deeper into the issue of test measurement, test reliability and test validity. A test is here used as an instrument for obtaining a sample of opinions about MM, retrieval, success/risk factors, system effectiveness and system viability.

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36A statistical hypothesis is a statement about one or more parameters of a population distribution that requires verification (Kirk, 1978).
Test measurements take place at the:
- interval level using a five point Likert-type scale (Mitchell & Jolley, 1992);
- nominal level using a dichotomous 'yes/no' scale (in a few cases only).

On a Likert-type scale, subjects usually respond to a statement by checking either "strongly agree" (scored a "5"), "agree" (scored a "4"), "undecided" (scored a "3"), "disagree" (scored a "2") or "strongly disagree" (scored a "1"). An example is given below.

Scarcity of multidisciplinary expertise is a typical risk factor for multimedia projects.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Strongly agree</th>
</tr>
</thead>
</table>

Depending on the question, variations are used, by offering Likert-type scales ranging from "very positive" to "very negative" etc. Traditionally, psychologists have assumed that Likert-type scales yield interval data, meaning that there is an equal psychological interval between each consecutive number. The advantage of Likert-type scales is that they yield more information than nominal-dichotomous items. More important, Likert-type items can be analysed by more powerful statistical tests, such as the t-test and ANOVA, than nominal-dichotomous items (Mitchell & Jolley, 1992). Another possibility of Likert-type scales is that answers to items measuring the same variables can be summated. An important advantages of this is that tests with summated scores are more reliable than one-question tests.

For these reasons, nominal-dichotomous items are used only sparingly in the expert assessment tests. If they are used the reason is that answers on the item are not intended to test a statistic hypothesis, or the use of interval scales looks too artificial.

The significance levels used are $\alpha = .05$ (p values of less than .05 are significant) and $\alpha = .01$ (p values of less than .01 are highly significant). Non significant (NS) p values are not presented.

The known methodological weaknesses of psychological tests are the threats to validity, "does the test measure what it purports to measure?", and reliability, "are the test results consistent?". Experts were specifically selected in several cases, because it is believed that they hold reasonable, consistent, opinions, and that they are able to make better informed judgements than a layman.

**Reliability**

Reliability, i.e., the repeatability of any measurement of a variable, is extremely important. Reliability is the consistency of test results, including the tendency of a test or measurement to produce the same results when it measures twice some entity or attribute, believed not to have changed in the interval between the measurements (Kidder, 1981).

Test-retest reliability is a convenient 'interpretation' of test reliability (Kidder, 1981). Yet, there are two major problems with test-retest reliability estimates (Allen & Yen, 1979):
- *Carry-over or learning effects*: the first testing may influence the second testing.
Time interval effects: long time intervals make effects due to changes in information or moods more likely. New market information or decisions on project budgets may influence the perceptions of the subjects between tests. As a consequence test reliability tends to be underestimated.

To estimate the test reliability another approach is also used: split-half test reliability. The test groups are split (odd/even) into two halves, and the correlation between the two halves is determined. The outcomes tend to be somewhat lower than test-retest reliability estimates of the whole test due to the smaller subgroups. To overcome this problem the Spearman-Brown Formula is used if the halves of the test are parallel (Allen & Yen, 1979).

If item scores need to be summated it is useful to determine Cronbach's coefficient $\alpha^{37}$ (Allen & Yen, 1979) for item homogeneity.

These three ways of estimating test reliability are used for the tests described in following sections.

Validity

Test validity is related to the question: do you measure what you want to measure? In this case: can we measure viability and related factors? It can be argued that sometimes an attempt is made to measure the unmeasurable, to predict future viability.

When performing expert assessment test one should be well aware of some validity threats.

- Test leader effects (Kidder, 1981): the biases of a test leader influences the experts, i.e., lead to subject biases (Mitchell & Jolley, 1992), thus influencing the outcome in the expected direction. For example, a test leader who shows little enthusiasm will probably get less positive responses about an MRS than a more enthusiastic test leader.

- Demonstration system effects: in the case where a demonstration is given, the quality of the demonstration influences the responses. For example, a very good demonstration of an MRS will lead to a different perception of its viability than a bad demonstration.

- Order effects (Kidder, 1981): the order of the stimuli presented to the expert panel may lead to unwanted interactions.

An attempt was made to reduce test leader effects by standardising the testing procedures and demonstration system effects by giving only 'realistic' demonstrations. Order effects are difficult to avoid completely in business settings.

Therefore, it is important to assess the validity of the tests, apart from more qualitative approaches with regard to content validity (e.g., face validity and logical validity) (Allen & Yen, 1979). Predictive validity (Allen & Yen, 1979) is of interest, as are external validity (Mitchell & Jolley, 1992), and concurrent validity (Allen & Yen, 1979). Let us have a closer look at the possibility of obtaining such viability estimates.

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37Be aware that coefficient $\alpha$, the reliability coefficient, is completely different from $\alpha$, the significance or confidence level of a statistical test.
The predictive validity of the tests used can only be measured by a longitudinal study: we must be able to wait 5 or 10 years and then look back and evaluate whether the MRS for M&S were as viable as expected. Such a longitudinal study is well beyond the scope of this research, and moreover, after 5 or 10 years the results of a longitudinal research design, however interesting from a methodological point of view, will no longer hold much interest for decision makers as new types of system will have evolved, making the results obsolete. Another interesting issue is external validity, i.e., to what degree can test results be generalised to other settings, subjects and times? In my research generalisation to other times is not very relevant, because it is assumed that the viability of MRSs for M&S varies with time; they have a certain life cycle. Generalisation to other settings and subjects is, however, of interest.

The concurrent validity of a test is demonstrated by a test and criterion scores when both measurements are obtained at (about) the same time. The concurrent validity of a test to measure the viability of an MRS over time can be obtained, for example, by making a comparison with market forecasts from independent market researchers (the criterion scores).

An attempt was made to estimate concurrent and external validity for several of the test described in the following sections.

5.3. Perceptions of the value added of MM and success/risk factors.

5.3.1. Introduction

A survey of MM projects was performed to test hypotheses about the value added of MM, the typical risk factors for MM projects and the risk factors for the introduction of MM products and services. With regard to the risk factors, only a small subset of factors were selected which were believed to be MM specific.

With regard to the value added of MM the hypotheses tested are summarised in the table below. These hypotheses are related to the H1 hypothesis discussed in chapter 4. Four alternative hypotheses were formulated which apply to M&S situations in which an effective information and knowledge transfer is needed.

<table>
<thead>
<tr>
<th>No</th>
<th>( H_1 ) - Alternative hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>The user friendliness of an IS improves with MM.</td>
</tr>
<tr>
<td>1-2</td>
<td>The presentation of information improves by using audio and video.</td>
</tr>
<tr>
<td>1-3</td>
<td>An MM message is understood better than a textual message.</td>
</tr>
<tr>
<td>1-4</td>
<td>Service to customers improves by using MSs.</td>
</tr>
</tbody>
</table>

Table 9. Overview of alternative hypotheses with regard to the value added of MM.
A general hypotheses is formulated about identified project management and system success/risk factors being critical for the viability of MRSs for M&S (H4) in the previous chapter.

With regard to the risk factors for MM projects four testable hypotheses were formulated which seem to be typical for MM projects: scarcity of multidisciplinary expertise (4-6), high production costs (4-7), complexity (4-5) and too little standardisation (4-8).

<table>
<thead>
<tr>
<th>No</th>
<th>H₁ - Alternative hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-5</td>
<td>Complexity is a typical risk factor for MM projects.</td>
</tr>
<tr>
<td>4-6</td>
<td>Scarcity of multidisciplinary expertise is a typical risk factor for MM projects.</td>
</tr>
<tr>
<td>4-7</td>
<td>High production costs for audio-visual information is a typical risk factor for MM projects.</td>
</tr>
<tr>
<td>4-8</td>
<td>Too little standardisation of MM products is a typical risk factor for MM projects.</td>
</tr>
</tbody>
</table>

Table 10. Overview of alternative hypotheses with regard to MM project management risk factors.

The hypotheses about risk factors for the introduction of MM products and services are also related to the general success/risk factors hypothesis H4 discussed in the previous chapter. The hypotheses about costs (4-9, 4-10 and 4-11) are related to the category of system success/risk factors 'system and usage costs'. Unstable standard (4-13) and becoming outdated quickly (4-14) are related to the category 'technical reliability'. Too little dissemination of use is added because it seems to be an inhibiting factor in a market which is still in its infancy. For example, if only a few people use certain MSs than the market for certain MR products and services is very small. It is very difficult to reach an acceptable ROI in such markets as a supplier of such products.

<table>
<thead>
<tr>
<th>No</th>
<th>H₁ - Alternative hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-9</td>
<td>High costs of hardware and software are a risk factor for the introduction of MM products and services.</td>
</tr>
<tr>
<td>4-10</td>
<td>High costs of using information services are a risk factor for the introduction of MM products and services.</td>
</tr>
<tr>
<td>4-11</td>
<td>High costs of telecommunication are a risk factor for the introduction of MM products and services.</td>
</tr>
<tr>
<td>4-12</td>
<td>Too little dissemination of use is a risk factor for the introduction of MM products and services.</td>
</tr>
<tr>
<td>4-13</td>
<td>Unstable standards are a risk factor for the introduction of MM products and services.</td>
</tr>
<tr>
<td>4-14</td>
<td>Products and services becoming outdated quickly are a risk factor for the introduction of MM products and services.</td>
</tr>
</tbody>
</table>

Table 11. Overview of alternative hypotheses with regard to the introduction of MM products and services
5.3.2. Method

Perceptions or opinions about the value added and risk factors were measured. An n=20 survey was performed from August to December 1993 with respondents from MM projects, mostly project leaders. Half of the respondents had participated in commercial (n=9) and half in research projects (n=11).

To test the hypotheses the experts were confronted with a number of statements about the value added of MM, and typical risk factors for MM projects and for the introduction of MM products and services (see appendix C.3.). Likert-type scales were used for the estimations that ran from 1 (Strongly disagree) to 5 (Strongly agree). The middle value 3 is 'neutral'.

An example of a question with regard to a statements is:

1.1. The user friendliness of an information system improves with MM

   Strongly disagree  1-------2-------3-------4-------5  Strongly agree

An example of a question with regard to a risk factor is:

2. The following risk factors are typical for multimedia projects:

   2.1. Complexity

   Strongly disagree  1-------2-------3-------4-------5  Strongly agree

The use of this scale resulted in the following general format of the null hypothesis and alternative hypothesis with regard to the hypotheses Hx-1 to Hx-14:

   \[ H_0: u \leq 3 \]
   \[ H_1: u > 3 \]

5.3.3. Results

A summary is given of t-test results in table 12 with regard to the hypotheses Hx-1 to Hx-14. In general, all means were in the direction (>3) as hypothesised, although not always at a confidence level of \( \alpha = 0.05 \).

With regard to the (perceived) value added of MM all the null hypotheses can be rejected. The null hypotheses H1-10 that the user friendliness of an IS does not improve by MM (p<.01, t=3.53, df=19), H1-20 that the presentation of information does not improve by usage of audio and video (p<.01, t=4.05, df=19), H1-30 that an MM message is not understood better than a textual message (p<.05, t=2.36, df=19), and H1-40 that the service to customers does not improve by usage of MSs (p<.01, t=5.57, df=19) can be rejected in favour of the respective alternative hypotheses. MM is perceived to have value added.
Chapter 5. Testing Hypotheses

<table>
<thead>
<tr>
<th>$H_j$</th>
<th>Statement</th>
<th>$\bar{X}$</th>
<th>$\sigma^2$</th>
<th>$\sigma$</th>
<th>$t$</th>
<th>$p&lt;$</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1-1</td>
<td>The user friendliness of an IS improves with MM</td>
<td>3.9</td>
<td>1.35</td>
<td>1.17</td>
<td>3.53</td>
<td>.01</td>
</tr>
<tr>
<td>H1-2</td>
<td>Presentation of information improves by adding audio and video</td>
<td>4.0</td>
<td>1.09</td>
<td>1.05</td>
<td>4.05</td>
<td>.01</td>
</tr>
<tr>
<td>H1-3</td>
<td>An MM message is better understood than a textual message</td>
<td>3.7</td>
<td>1.58</td>
<td>1.28</td>
<td>2.36</td>
<td>.05</td>
</tr>
<tr>
<td>H1-4</td>
<td>The service to customers improves by using MSs</td>
<td>4.1</td>
<td>0.76</td>
<td>0.86</td>
<td>5.57</td>
<td>.01</td>
</tr>
<tr>
<td>H4-5</td>
<td>Complexity is a risk factor</td>
<td>3.9</td>
<td>1.33</td>
<td>1.17</td>
<td>3.45</td>
<td>.01</td>
</tr>
<tr>
<td>H4-6</td>
<td>Scarcity of multidisciplinary expertise</td>
<td>4.0</td>
<td>1.29</td>
<td>1.15</td>
<td>3.71</td>
<td>.01</td>
</tr>
<tr>
<td>H4-7</td>
<td>High production costs for audio-visual information</td>
<td>3.4</td>
<td>1.57</td>
<td>1.28</td>
<td>1.44</td>
<td>NS</td>
</tr>
<tr>
<td>H4-8</td>
<td>Too little standardisation of MM products</td>
<td>3.7</td>
<td>1.16</td>
<td>1.09</td>
<td>2.96</td>
<td>.01</td>
</tr>
<tr>
<td>H4-9</td>
<td>Costs of hardware and software</td>
<td>3.5</td>
<td>1.14</td>
<td>1.09</td>
<td>1.83</td>
<td>.05</td>
</tr>
<tr>
<td>H4-10</td>
<td>Costs of using information services</td>
<td>3.2</td>
<td>0.69</td>
<td>0.86</td>
<td>1.10</td>
<td>NS</td>
</tr>
<tr>
<td>H4-11</td>
<td>Costs of telecommunication</td>
<td>3.6</td>
<td>1.51</td>
<td>1.26</td>
<td>1.97</td>
<td>.05</td>
</tr>
<tr>
<td>H4-12</td>
<td>Too little dissemination of the use</td>
<td>3.5</td>
<td>1.17</td>
<td>1.10</td>
<td>1.81</td>
<td>.05</td>
</tr>
<tr>
<td>H4-13</td>
<td>Unstable standards</td>
<td>3.1</td>
<td>1.39</td>
<td>1.21</td>
<td>0.21</td>
<td>NS</td>
</tr>
<tr>
<td>H4-14</td>
<td>Fast outdatedness of products and services</td>
<td>3.1</td>
<td>1.25</td>
<td>1.15</td>
<td>0.41</td>
<td>NS</td>
</tr>
</tbody>
</table>

Table 12. Overview of reactions to statements about MM by MM project members

The experts agreed ($\bar{X}=4$) with the statements that the user friendliness of an IS improves by MM ($\bar{X}=3.9$), the presentation of information improves when using audio and video ($\bar{X}=4.0$), service to customers improves by using MSs ($\bar{X}=4.1$). They tended to agree with the statement that an MM message is better understood than a textual one ($\bar{X}=3.7$), although it was remarked that this depends on the type of message and the type of audience.

![Value Added of MM](image)

Figure 37. Bar chart showing mean reactions to statements for the value added of MM

With regard to the (perceived) risk factors for MM projects three out of four null hypotheses can be rejected in favour of the alternative hypotheses. As expected, the null hypotheses $H4-50$ that complexity is not a typical risk factor for MM projects ($p<.01$, $t=3.45$, $df=19$), $H4-60$ that scarcity of multidisciplinary expertise is not a typical risk factor.
for MM projects (p<.01, t=3.71, df=19), and H4-80 that too little standardisation of MM products is not a typical risk factor for MM projects (p<.01, t=5.57, df=19) can be rejected in favour of the respective alternative hypotheses. Only the null hypothesis H4-70 that high production costs of audio-visual information is not a typical risk factor for MM projects (p=NS, t=1.44, df=19) cannot be rejected, although the outcome is in the expected direction (X̄=3.4). High variance (1.57) can be noted with regard to the high production costs, indicating that there was little consensus about to what degree it is a risk factor.

The experts agreed (X̄=4) that complexity (X̄=3.9), scarcity of multidisciplinary expertise (X̄=4.0), and tended too agree that too little standardisation of MM products (X̄=3.7), are risk factors for MM projects.

<table>
<thead>
<tr>
<th>Risk factors MM projects</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>complexity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>multidisciplinary expertise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>costs audiovisual information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>little standardisation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 38. Bar chart showing mean reactions for typical risk factors for MM projects

With regard to the (perceived) risk factors for the introduction of MM products and services three out of six null hypotheses can be rejected in favour of the alternative hypotheses. The null hypotheses H4-90 that the costs of hardware and software are not a risk factor for the introduction of MM products and services (p<.05, t=1.83, df=18), H4-110 that the costs of telecommunication are not a risk factor for the introduction of MM products and services (p<.05, t=1.97, df=18), and H4-120 that too little dissemination of the use is not a risk factor for the introduction of MM products and services (p<.05, t=1.81, df=18) can be rejected in favour of the respective alternative hypotheses as expected. The null hypotheses H4-100 that the costs of using information services are not a risk factor for the introduction of MM products and services (p=NS, t=1.10, df=18), H4-130 that unstable standards are not a risk factor for the introduction of MM products and services (p=NS, t=0.21, df=17), H4-140 that fast outdated of products and services is not a risk factor for the introduction of MM products and services (p=NS, t=0.41, df=18), cannot be rejected, since the outcomes are only in the direction expected (respectively X̄≈3.2, X̄≈3.1 and X̄≈3.1).

The experts tended to agree (X̄=3.5) that the costs of hardware and software (X̄=3.5), the costs of telecommunication (X̄=3.6), and too little dissemination of use (X̄=3.5) are risk factors for the introduction of MM products and services.
Reliability

The reliability coefficient of the test was estimated using the Spearman-Brown Formula. The reliability estimate of 0.73 is not very high. This implies that we should be careful when interpreting the test outcomes.

<table>
<thead>
<tr>
<th>Split half correlation coefficient</th>
<th>0.57</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spearman-Brown coefficient</td>
<td>0.73</td>
</tr>
</tbody>
</table>

Table 13. Computation of test reliability estimates using the Spearman-Brown Formula.

It is assumed that the average test item outcomes for research respondents ($\bar{X} = 3.7$) and non-research respondents ($\bar{X} = 3.6$) stem from the same population, that the test means are equal. A two-sample t-test shows that this assumption need not to be rejected ($p = .61$, $t = -0.52$, df = 14) indeed. (On item level: 12 of 14 items did not show significant differences between both groups; see appendix C.3.).

5.3.4. Discussion

My expectations about the value added of MM were confirmed by the respondents, meaning that it is also their opinion that, in general, MM has value added (H1): MM improves the user friendliness of an IS, audio and video improves the presentation of information, an MM message is better understood than a textual one, and service to customers improves with the use of MM. These opinions are probably only valid to a certain degree: we can validate such opinions by usability testing and by effectiveness measurements.

My expectation that complexity, scarcity of multidisciplinary expertise, and too little standardisation of MM projects are typical risk factors for MM projects were confirmed by the respondents (H4). Less consensus exists about the high production costs of audio-visual
information, some respondents agreed and some disagreed that this is a typical risk factor for MM projects. An argument for this is that the costs of audio-visual information production are relatively easy to assess, and that they form only a limited part of the total development costs. Moreover, in many MM projects no new audio-visual information is produced, already available audio-visual information is re-used.

For the introduction of MM products and services the respondents believe, as expected, that the costs of hardware and software, the costs of telecommunication and too little dissemination of the use are risk factors.

These latter risk factors are not only typical for MM products and services.

It is interesting to note that too little standardisation is seen as a risk factor for MM projects, but that unstable standards are seen as 'neutral' for the introduction of MM products and services. Perhaps this is because standards are always unstable, evolving (see chapter 2), and that it depends on other qualities of products and services if they are successful or not (e.g., the price/performance ratio).

The validity of risk factors can be further analysed by comparing successful and unsuccessful projects, and products and service introductions.

5.4. Expert assessment of the viability of MM teleservices

5.4.1. Introduction

A market survey on tele-applications resulted in a clustering of MM teleservices which are believed to be viable. These clusters included a teleshopping/telemarketing cluster (Peeters & Koenen, 1993). These clustered MM teleservices may form applications in a future Virtual Market (VM). They include several of the MRSs (see chapter 3) with telecommunication extensions. For example, an extended TSA, MBC or MPS may belong to the cluster teleshopping/telemarketing. Although the teleshop/telemarketing cluster is particularly relevant to this research, the other clusters are relevant as well. An on-line accessible MCA belongs to the electronic publishing/information retrieval cluster, while several of the MRSs, e.g., the MDA or MAI, belong clearly to the cluster office/process automation.

The question is, based on the viability hypothesis H3: do the recognised MM clusters contain viable telecommunication applications in the short term (0-2 years), in the medium term (2-5 years) and in the long term (5-10 years)? Since our particular attention is focused on M&S, our focus must be on the judgements for teleshopping and telemarketing.

The alternative hypotheses can be formulated, in natural language, as follows:

H3-1: The MM clusters are important for the telecommunication business.

H3-2: MM teleshopping/telemarketing is important for the telecommunication business.
It can also be hypothesised that there is a strong positive relationship between the importance of an MM cluster, or MM teleshopping/telemarketing in particular, and time:

H3-3: The importance of MM clusters for the telecommunication business increases with time.

H3-4: The importance of MM teleshopping/telemarketing for the telecommunication business increases with time.

5.4.2. Method

In December 1993 a meeting with 18 MM experts of PTT Research, most project leaders, was organised as part of the PTT Research MIPS project. At the beginning and at the end of the meeting all the MM experts were asked to fill in a questionnaire (see appendix C.1.).

To test the hypotheses the experts are asked for their importance estimates for an MM cluster in the short term (0-2 years), in the medium term (2-5 years) and in the long term (>5 years). Interval scales are used for the estimations that run from 1 (very unimportant) to 5 (very important). The middle value 3 is 'neutral'. An example of a question is given below:

2. How important is the multimedia cluster teleshopping/telemarketing for the business of PTT Telecom?

0-2 years:
Very unimportant 1---------2---------3---------4---------5
Very important

2-5 years:
Very unimportant 1---------2---------3---------4---------5
Very important

>5 years:
Very unimportant 1---------2---------3---------4---------5
Very important

The use of this scale results in the following general format of the null hypothesis and alternative hypothesis with regard to the hypotheses H3-1 to H3-4:

\[ H_0: u \leq 3 \]
\[ H_1: u > 3 \]

It was expected that the expert estimates would be highly correlated with time in the sense that the mean estimates for the long term (>5 years) would be higher than the mean estimates for the medium term (2-5 years), and that in their turn the mean estimates for the medium term would be higher than those for the short term (0-2 years). Thus, the general format for the H3-3 and H3-4 null hypotheses and the alternative hypotheses is:
\[ H_0: u_{0-2 \text{ years}} \geq u_{2-5 \text{ years}} \geq u_{>5 \text{ years}} \]
\[ H_1: u_{0-2 \text{ years}} < u_{2-5 \text{ years}} < u_{>5 \text{ years}} \]

5.4.3. Results

As can be seen in summary table 14, no MM cluster was seen as important for the telecommunication business on the short term (0-2 years), at a significance level of α=.05. In the medium term (2-5 years) almost all MM clusters estimates were significantly above 'neutral', with the exception of estimates for Security and electronic publishing/information retrieval. In the long term (>5 years) all clusters were seen as important, and all these results are significant or highly significant. When taking the cluster means the same significance pattern as seen for the medium term, is repeated.

The experts saw the teleshopping/telemarketing cluster as important for the telecommunication business, but this estimation is only significant on the middle (p<.01, t=2.82, df=17) and the long term (p<.01, t=5.36, df=17). Thus, H3-20 that the clusters are not viable can be rejected for the teleshopping/telemarketing cluster.
Table 14. Overview of importance estimates of an MM cluster for the business of a telecommunication company as assessed by MM telecommunication experts (n=18).

To test the hypothesis (H3-10) that the experts are not positive about the MM telecommunication clusters in general, a one-sample t-statistic was performed on the expert means (see appendix C.1.). The result is that the H3-10 hypothesis can be rejected: the mean expert estimate (3.51) is significantly t<.01, df=17, t=3.42) above 'neutral' (3).

The H3-3 and H3-4 alternative hypotheses that there is a positive relationship between time and the level of importance are formulated above. An ANOVA was used to test the H3-3 null hypothesis for mean item outcomes and to test the H3-4 null hypothesis for the teleshopping/telemarketing outcomes. The outcomes of both ANOVA tests are highly significant t<.01, see table 15), meaning that the null hypothesis can be rejected. Given that no inverse relationship between 'importance' and 'time' is found, the alternative hypotheses H3-3 and H3-4 are supported. The expert expectations for the MM clusters, and for MM teleshopping/telemarketing in particular, increase significantly with time.

Table 15. Test 1 ANOVA outcomes for item means and teleshopping/telemarketing in particular.

Reliability

The test-retest reliability is a convenient 'interpretation' of test reliability (Kidder, 1981). Thus, the same subjects were confronted a second time with the same test on the same day (about 4 hours later). The results are summarised in table 16 below.

---

38The ANOVA, ANalysis Of VAriance, (Kirk, 1978) was used because it would otherwise take two separated t-tests to test the same null hypothesis.
Table 16. Results of the second test. Mean importance estimates of an MM cluster for the business of a telecommunication company as assessed by MM telecommunication experts (n=18).

<table>
<thead>
<tr>
<th>Test 2 means</th>
<th>0&lt;2 years</th>
<th>2-5 years</th>
<th>&gt;5 years</th>
<th>Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVT</td>
<td>3.4</td>
<td>4.1</td>
<td>4.6</td>
<td>4.0</td>
</tr>
<tr>
<td>Teleshopping/ telemarketing</td>
<td>2.2</td>
<td>2.8</td>
<td>3.2</td>
<td>2.7</td>
</tr>
<tr>
<td>Infotainment</td>
<td>2.8</td>
<td>3.8</td>
<td>4.3</td>
<td>3.6</td>
</tr>
<tr>
<td>Security</td>
<td>2.6</td>
<td>2.9</td>
<td>3.0</td>
<td>2.8</td>
</tr>
<tr>
<td>MM store &amp; forward services</td>
<td>2.5</td>
<td>3.1</td>
<td>3.5</td>
<td>3.0</td>
</tr>
<tr>
<td>Electronic publishing/IR</td>
<td>2.3</td>
<td>2.9</td>
<td>3.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Office/process automation</td>
<td>3.1</td>
<td>3.6</td>
<td>4.0</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Figure 41. Scatter diagram showing the test-retest scores for the test items.

The correlation coefficient between test and retest outcomes is 0.89 (see figure 41 and the summary table below). This high correlation gives confidence in the reliability of the assessment method. There are two relevant test-retest reliability problems (see section 5.2.).

- A carry-over or learning effect might have been present because the time between the test was short (about 4 hours): the subjects could still remember the answers they gave the first time. The effects of this are rather unpredictable: it may lead to repeating answers, or it may lead to more differentiated answers.
- Time effects were reduced by keeping the time interval short. Nevertheless, a time interval effect did occur as a discussion of MM matters took place in between tests!
To estimate the test reliability another approach was also used: split-half test reliability using the Spearman-Brown Formula (see section 5.2.). The results are given both for the first and the second test in the table below.

The conclusion is that the reliability of the test is satisfactory high, about 0.9. The fact that the Spearman-Brown reliability estimates approach the test-retest reliability coefficient so closely confirms the idea that the Spearman-Brown estimate is a useful alternative when test-retest reliability estimates cannot be computed.

<table>
<thead>
<tr>
<th>Test-retest reliability</th>
<th>0.89</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split-half test correlation coefficient</td>
<td>0.80</td>
</tr>
<tr>
<td>Test reliability (Spearman-Brown Formula)</td>
<td>0.89</td>
</tr>
<tr>
<td>Split-half retest correlation coefficient</td>
<td>0.83</td>
</tr>
<tr>
<td>Retest reliability (Spearman-Brown Formula)</td>
<td>0.91</td>
</tr>
</tbody>
</table>

Table 17. Test reliability estimates.

It can thus be assumed that the experts were consistent in their estimations. To test this assumption a t-statistic was performed on the estimates of experts per item for the first and second test. In table 18 the outcomes are shown indicating that there are no significant statistical differences (p=NS, df=34, t=1.46) between the mean outcomes of test 1 (3.5) and test 2 (3.2).

Statistical differences are present, however, between the mean outcomes for the first and second test with regard to cluster means (p<.05, df=6, t=2.57) and, more seriously, teleshopping/telemarketing (p<.01, df=34, t=2.94). Furthermore, the test 2 teleshopping/telemarketing outcomes even in the long term are only slightly, not significantly, above 'neutral' (3.2) (see appendix C.1.).

| Expert means | 34 | 18 | 1.46 | NS |
| Cluster means | 6 | 7 | 2.57 | .05 |
| AVT | 34 | 18 | -0.13 | NS |
| Teleshopping/Telemarketing | 34 | 18 | 2.94 | .01 |
| Infotainment | 34 | 18 | 0.21 | NS |
| Security | 34 | 18 | 1.41 | NS |
| MM Store & Forward services | 34 | 18 | 1.57 | NS |
| Electronic Publishing | 34 | 18 | 1.05 | NS |
| Office & Process Automation | 34 | 18 | 0.05 | NS |

Table 18. Two-tailed two-sample t-test summary table.
Although, the test reliability is satisfactory, about 0.9, the significant lower teleshopping/telemarketing estimates in the retest, which are about 'neutral' and for which thus the H3-20 hypothesis cannot be rejected, make it difficult to interpret the results with regard to this hypothesis.

**Concurrent validity**

An indication of the validity of the expert ratings can be obtained by looking at the correlation of the ratings with a concurrent criterion. In this case, market growth estimates from OVUM (Jeffcoate et al., 1993) were used as the concurrent criterion. The outcomes are:

- a correlation coefficient of **0.99** between the expert AVT estimates and the OVUM estimates for revenues from videoconferencing traffic in Europe and the USA for telecommunication companies; OVUM estimates these revenues will grow from $446 million in 1992 to $2,223 in 2000;
- a correlation coefficient of **0.89** between the mean scores for the short/middle/long term, (2.96, 3.57 and 4 respectively, and the OVUM estimates for revenues from MM PC traffic for telecommunication companies; OVUM estimates these revenues will grow from $1 million in 1992 to $1,295 million in 2000.
Figure 43. Comparison of highly correlated, but significantly different, forecasts for the videoconferencing market.

We should be careful with interpreting these correlation coefficients, because market forecasts have a limited reliability and validity. For example, the comparable OVUM and YankeeGroup (1992) estimates for the total videoconferencing market from 1992-1996 are highly correlated (0.92), since they both predict ongoing growth, but at a very different growth rate and therefore the forecasts of The YankeeGroup are significantly (p<0.05; \( t=2.36, \df=4 \)) more optimistic than the outcomes of OVUM (see figure 43). Which one is valid?

Nevertheless, we can conclude from the high concurrent validity coefficients that the expert judgements about the growing importance of MM for telecommunication are in agreement with market forecasts.

5.4.4. Discussion

The null hypothesis that MM clusters are not important for the telecommunication business can be rejected for some clusters and for all clusters in the long term (>5 years). The hypothesis that MM teleshopping/telemarketing is not important for the telecommunication business can also be rejected for the mean and long term. The retest results, however,
throws a shadow over this latter result, probably due to the effects of the discussion about MM clusters that took place in-between the test and retest. Yet, the hypothesis that the importance of MM clusters, and MM teleshopping/telemarketing in particular, for the telecommunication business does not increase with time can be rejected in favour of the alternative hypothesis. These expectations correspond with market forecasts and widespread expectations within the telecommunications industry.

Thus, one can conclude that it is expected that the MM clusters, among which MM teleshopping/telemarketing, are becoming important from a telecommunication company's point of view, but that there is uncertainty about at what speed this is going to happen and at what level of profitability.

5.5. Expert evaluation of an MBC and the value added of MR

5.5.1. Introduction

As is shown by an evaluative study (Hoogeveen, 1993c) the paper General Specification pages catalogue of PTT Telecom, containing a two pages description of every product and service for the business market, has a number of quality problems: too low topicality (63%-90%) and too low completeness (58%). An MBC would solve at least one of these problems: low topicality.

It is then necessary to ask, will an MBC offering MR facilities be effective, and what MM elements and retrieval facilities have value added?

On the bases of H5, about the (perceived) effectiveness of MRSs for M&S, it is hypothesised that:

H5-1: The MBC is judged to be better than a paper catalogue.

On the basis of H1, about the value added of MM, and H2, about the value added of retrieval, it is hypothesised that added MM elements and added retrieval facilities will be judged positively in case of an MBC.

A number of information types were selected to be judged for the MBC: video, speech, and colour pictures. A number of retrieval facilities were also selected for testing: hyperlinking, search fields, graphical browsing (i.e., backtracking with a history function), full text searches, hierarchical indexing using menu structures, and browsing through reducible sets using product names. The MM elements chosen are believed to offer value added when showing product and services information. The selected retrieval facilities are the simpler ones, that do not need much explanation for a relatively inexperienced computer user, as are most sales people.

The general forms of the alternative hypotheses about these elements and facilities are:
H1: Offering the MM element is judged positively by M&S experts.

H2: Offering the retrieval facility is judged positively by M&S experts.

The idea is that these judgements on the effectiveness of an MBC and value added of MM and retrieval give indications of the viability of an MBC (H3).

5.5.2. Method

Between August 1993 and December 1994 an MBC demonstrator based on the paper General Specification pages catalogue was developed as part of the PROMISE project within PTT Research (Derksen, 1994). The MBC demonstrator contains two main modules: a module for compiling a tailor-made catalogue, and a presentation module to access the contents of the MBC.

Figure 44. Searching and presenting a product using the MBC demonstrator.

The demonstrator includes all the MM elements and retrieval facilities mentioned above. Video is offered in a small window at the start of the 'specification pages' of a product or service. Corporate TV commercials were digitised for this purpose. Speech is offered as
part of the video clips, and is also offered to read aloud the text of the product or service descriptions. A colour picture is included for every product which can be blown up to screen size if the picture is clicked on. Since the presentation module contains the complete selection of MM elements and retrieval facilities most of the presentation time was dedicated to showing the presentation module.

An M&S expert panel was formed, consisting of PTT Telecom M&S staff people to evaluate the MBC demo and test the hypotheses. 18 people were invited for the expert panel, but only 15 people were actual available for an evaluation session.
The session consisted of the presentation of the MBC demonstrator, a short period of questions and answers led by the presenter, and the filling in of a questionnaire (see appendix C.4.) by the M&S experts.

To test the main hypothesis about the value added of an MBC an interval scale was used that runs from 1 (much worse) to 5 (much better). The middle value 3 is 'neutral'. An example of a question is:

1. Do you think that a similar [as demonstrated] multimedia catalogue is better or worse than a paper catalogue for sales support?

   Much worse    1--------2----------3----------4-------- 5    Much better

To test the hypotheses about the MM elements and retrieval facilities interval scales were used that run from 1 (very negative) to 5 (very positive). The middle value 3 is 'neutral'. An example of a question is:

2. How do you judge the addition of video to the catalogue?

   Very negative 1--------2----------3----------4-------- 5    Very positive

The use of these scales results in the following general format for the null hypothesis and alternative hypothesis with regard to the hypotheses formulated in the foregoing section:

   \( H_0: u < 3 \)

   \( H_1: u > 3 \)

The relevant validity threats are test leader effects and demonstration system effects (see section 5.2.).

5.5.3. Results

An MBC was judged to be better (\( \bar{X} = 3.9 \)) than the paper catalogue. Thus, the null hypothesis that an MBC is not judged to be better than a paper catalogue can be rejected (\( p < .01, t = 5.77, \text{df} = 13 \)) (see table 19).
All the judgements on MM elements and retrieval facilities are in the expected direction (\(\bar{X} > 3\)). Since the test results (see table 19) are significant at a confidence level of .05 (speech, full text) or .01, all the others, the null hypotheses for these elements and retrieval facilities can be rejected in that their addition to an MBC was not judged positively.

<table>
<thead>
<tr>
<th>Item</th>
<th>(\bar{X})</th>
<th>(\sigma^2)</th>
<th>(\sigma)</th>
<th>(t)</th>
<th>(p&lt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>MM catalogue is better than paper catalogue</td>
<td>3.9</td>
<td>0.42</td>
<td>0.65</td>
<td>5.77</td>
</tr>
<tr>
<td>1-2</td>
<td>Judgement on the addition of video</td>
<td>3.8</td>
<td>0.72</td>
<td>0.85</td>
<td>3.75</td>
</tr>
<tr>
<td>1-3</td>
<td>Judgement on the addition of speech</td>
<td>3.5</td>
<td>1.09</td>
<td>1.05</td>
<td>2.17</td>
</tr>
<tr>
<td>1-4</td>
<td>Judgement on the addition of colour photographs</td>
<td>4.5</td>
<td>0.48</td>
<td>0.69</td>
<td>9.41</td>
</tr>
<tr>
<td>2-5</td>
<td>Judgement on hyperlinking support</td>
<td>4.0</td>
<td>0.85</td>
<td>0.92</td>
<td>4.42</td>
</tr>
<tr>
<td>2-6</td>
<td>Judgement on supporting key word searches</td>
<td>3.6</td>
<td>0.58</td>
<td>0.76</td>
<td>3.22</td>
</tr>
<tr>
<td>2-7</td>
<td>Judgement on the possibility of having a history function</td>
<td>3.9</td>
<td>0.44</td>
<td>0.66</td>
<td>5.49</td>
</tr>
<tr>
<td>2-8</td>
<td>Judgement on the possibility of using full text searches</td>
<td>3.6</td>
<td>0.78</td>
<td>0.88</td>
<td>2.92</td>
</tr>
<tr>
<td>2-9</td>
<td>Judgement on the possibility of searching by menus</td>
<td>3.7</td>
<td>0.84</td>
<td>0.91</td>
<td>3.32</td>
</tr>
<tr>
<td>2-10</td>
<td>Judgement on the possibility of searching by browsing</td>
<td>3.6</td>
<td>0.52</td>
<td>0.72</td>
<td>3.80</td>
</tr>
</tbody>
</table>

Table 19. Summary one-sample t-test results for the MBC demonstrator

The use of colour pictures especially was judged 'positive' to 'very positive' (\(\bar{X} = 4.5\)). The use of video was judged 'positive' (\(\bar{X} = 3.8\)), probably because of imperfect projection by a transview on an overhead projector of moving pictures. Speech was judged 'neutral' to 'positive' (\(\bar{X} = 3.5\)): reading text aloud was not seen as a really valuable addition.
All search facilities were judged 'positive' (3.5<\bar{X}<4.5), with hyperlinking and graphical browsing in the form of a history function as positive extremes.

**Reliability**

The outcomes of the test reliability computation for all items using the Spearman-Brown Formula, is not really convincing, a reliability of about .5, due to a low correlation for retrieval items. The test reliability is more satisfactory (0.78) for the MM items alone.

<table>
<thead>
<tr>
<th></th>
<th>Split-half correlation coefficient</th>
<th>Spearman-Brown Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>All items</td>
<td>0.34</td>
<td>0.50</td>
</tr>
<tr>
<td>MM items only</td>
<td>0.64</td>
<td>0.78</td>
</tr>
<tr>
<td>retrieval items only</td>
<td>0.21</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Table 20. Reliability estimates using the Spearman-Brown Formula

**5.5.4. Discussion**

The positive judgements on the MBC as demonstrated by the MBC demonstrator and its elements and facilities are encouraging, but it does not mean that every paper catalogue should be replaced by an MM catalogue and that all MM elements and retrieval facilities judged positively are always needed. Remarks made by the respondents indicated that an MBC should contain additional (not demonstrated) functionality for customer profiles and customer history, print functionality, references to happy client situations to demonstrate the use of products and services, and accessing related information systems.

If the positive expert judgement about the MBC in comparison to a paper catalogue is a valid and representative measure, than a positive statement about the viability of MBCs in general seems justified. Yet, a generic judgement like this does not say much about the viability of an MBC for a specific business situation.

**5.6. Expert evaluation of a promotional CD-i and the value added of MR**

**5.6.1. Introduction**

Hypotheses, that are comparable to those tested with the MBC demo, were tested using a demo on a CD-i. There is one main difference: the CD-i was positioned as a promotional system that can be consulted occasionally by a wide range of potential customers, whilst the MBC will be used by business sales staff and business customers.
Nevertheless it is interesting to make comparisons between the outcomes of both evaluations (see section 5.7.).

The main alternative hypothesis, based on hypothesis H5 about system effectiveness, is:

H5-1: The CD-i is seen as a useful medium for M&S by M&S experts

Note that 'useful' is used as interchangeable with 'effective'. Further it is assumed that a medium that proves to be effective for M&S in terms of meeting business objectives is also viable.

On the basis of H1, about the value added of MM, a number of MM elements, information types, were selected to be tested on the CD-i: video, music, pictures, and speech. On the basis of H2, about the value added of retrieval, a number of retrieval facilities were also selected to be tested: hyperlinking, hierarchical indexing in the form of menu structures, browsing and search fields. The MM elements are believed to be of great value for marketing product information. The retrieval facilities selected are the simpler ones, that need little explanation for a relative inexperienced computer user to use.

The general forms of the alternative hypotheses about these elements and facilities are:

H1-1: Offering the MM element is judged positively by M&S experts.
H2-1: Offering the retrieval facility is judged positively by M&S experts.

The idea is that judgements on the effectiveness of a promotional CD-i and value added of MM and retrieval give indications of the viability of an MPS (H3).

5.6.2. Method

An MR demonstrator on CD-i was developed for PTT Telecom with the theme 'Mobile communication products' between November 1993 and January 1994. The actual development of this CD-i title was done in collaboration with the CD-i developer Merlin. The CD-i contains five modules: a mobile products catalogue, a slide show with these products, news in the form of TV commercials, an animation to explain the operation of a mobile telephone, a Greenhopper, and an explanation of how to produce a CD-i in the form of an interactive sheets presentation.

The CD-i title includes most of the MM elements and retrieval facilities mentioned in the foregoing section, however, browsing was only implemented to a limited extend, and search fields were not implemented at all because this was beyond the available budgets as it requires a lot of programming effort to realise this on CD-i.

To evaluate the CD-i demo and to test the hypotheses an M&S expert panel was formed, consisting of PTT Telecom M&S staff. 18 people were selected for the expert panel, but only 15 people were actual available for an evaluation session.
The session consisted of a presentation of the CD-i demonstrator, a question and answer session controlled by the presenter, and the filling in of a questionnaire (see appendix C.5.) by the M&S experts. The CD-i session followed on after the MBC demonstration session.

Figure 46. Searching and presenting a product using the CD-i demonstrator.

For the main usefulness hypotheses (H5-1) a nominal (yes/no) scale was used. The related question in the questionnaire was formulated as follows:

1. **Do you think that the CD-i is a useful medium for marketing & sales?**  
   
   *yes/no*

Interval scales are used for the hypotheses on the MM elements and retrieval facilities. The scales used run from 1 (very negative) to 5 (very positive). The middle value 3 is 'neutral'. An example of a question is:

1. **How do you judge the addition of video to product presentations for customers?**  
   
   *Very negative*  
   
   1---------2---------3---------4---------5  
   
   *Very positive*

The use of this scale results in the following general format of the hypotheses with regard to the MM elements and retrieval facilities:
Chapter 5. Testing Hypotheses

\( H_0: u \leq 3 \)
\( H_1: u > 3 \)

5.6.3. Results

Of the 15 M&S experts 14 judged the CD-i to be a useful medium for M&S, 1 expert did not respond. (This is a highly significant result: \( p < .01, \chi^2 = 14.071, \text{df}=1 \)). So the null hypothesis that the MR possibilities of the CD-i are not seen as useful for M&S can be rejected.

The interesting M&S applications mentioned by the respondents, the no. of responses for each category is given between brackets, are:

- POL/POS in shops (9), Primafoons, Business Centres, and dealer shops, for example, to support sales conversations;
- instruction for sales people, dealers and customers (8);
- demonstrations and presentations at fairs and seminars (6);
- support of corporate image and PR (3);
- catalogues and product information in general (2);
- information transfer towards the consumer at home (1);
- order intake, when using a Tele-CD-i (1);
- distribution of data and visuals (1).

![CD-i evaluation diagram](image)

**Figure 47. Mean experts judgements on CD-i MM and retrieval aspects**

A graphic representation of the expert judgements is shown in figure 47. Since search fields and browsing were not shown on the CD-i demo the scale for these two items runs from not necessary (1) to necessary (5). For the other items, the scale runs from very negative (1) to very positive (5).
As can be seen from t-test summary table 21, the outcome is not significant only for browsing. As a result the null hypothesis that browsing is not seen as a necessary retrieval facility cannot be rejected. The judgement about browsing was about 'neutral' (3.3).

Table 21 demonstrates that all the MM elements are judged significantly above 'neutral', meaning that the respective null hypotheses that these elements are not judged positively (less than or equal to 3) can be rejected. Both the use of speech and video are judged 'positive' to 'very positive' ($\bar{X}$=4.4 and $\bar{X}$=4.5 respectively). The experts report that the combined use of video and speech holds attention, and makes the presentation persuasive ("seeing is believing").

<table>
<thead>
<tr>
<th>H</th>
<th>$\bar{X}$</th>
<th>$\sigma^2$</th>
<th>$\sigma$</th>
<th>t</th>
<th>p&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1 Judgement on the addition of video</td>
<td>4.5</td>
<td>0.25</td>
<td>0.50</td>
<td>12.728</td>
<td>.01</td>
</tr>
<tr>
<td>1-2 Judgement on the addition of speech</td>
<td>4.4</td>
<td>0.52</td>
<td>0.72</td>
<td>8.067</td>
<td>.01</td>
</tr>
<tr>
<td>1-3 Judgement on the addition of music</td>
<td>3.7</td>
<td>0.64</td>
<td>0.80</td>
<td>3.725</td>
<td>.01</td>
</tr>
<tr>
<td>1-4 Judgement on the addition of colour photographs</td>
<td>3.9</td>
<td>0.55</td>
<td>0.74</td>
<td>4.947</td>
<td>.01</td>
</tr>
<tr>
<td>2-5 Judgement on hyperlinking support</td>
<td>4.0</td>
<td>0.17</td>
<td>0.41</td>
<td>9.873</td>
<td>.01</td>
</tr>
<tr>
<td>2-6 Judgement on the possibility for searching by menus</td>
<td>3.7</td>
<td>0.95</td>
<td>0.98</td>
<td>2.898</td>
<td>.01</td>
</tr>
<tr>
<td>2-7 Judgement on the necessity for searching by browsing</td>
<td>3.3</td>
<td>1.10</td>
<td>1.05</td>
<td>1.351</td>
<td>NS</td>
</tr>
<tr>
<td>2-8 Judgement on the necessity for key word searching</td>
<td>3.6</td>
<td>0.97</td>
<td>0.99</td>
<td>2.583</td>
<td>.05</td>
</tr>
</tbody>
</table>

Table 21. Summary table with t-test outcomes.

Colour photographs and music were judged 'positive' ($\bar{X}$=3.9 and $\bar{X}$=3.7 respectively). A remark made by respondents about the photographs was that they do not look very dynamic in comparison to video and speech on CD-i. With regard to music several experts noted that the choice of music is very complicated because the tastes of people differ so much. Music that is too obtrusive should be avoided.

The retrieval facility hyperlinking was judged 'positive' ($\bar{X}$=4.0), this outcome is highly significant (p<.01, t=9.837, df=14). The use of menu structures was also judged 'positive' ($\bar{X}$=3.7), this outcome was also highly significant (p<.01, t=2.898, df=14). So, the null hypotheses that hyperlinking and menu structures are not judged 'positive' (values less than or equal to 3) can be rejected. A problem reported with hierarchical menu structures for retrieval of information is that it may take a long time to find the right information.

As hypothesised, the experts saw the use of search fields as necessary ($\bar{X}$=3.6), and this outcome is significant (p<.05, t=2.583, df=14).
Reliability

What is the reliability of this expert assessment? In the previous reliability measurement case the use of the Spearman-Brown coefficient based on the split halves coefficient proved useful (see section 5.2.). The Spearman-Brown coefficient is 0.70. This is a reasonable but not high reliability coefficient. This can be explained from differences in the variance (see $\sigma^2$ in table 21): the variance of the answers for retrieval items is much larger than for MM items. As can be seen in table 22 test reliability for MM items only is very high (0.98), whilst test reliability for retrieval items only is not really convincing (0.51). In other words: there was a stronger consensus about the value added of the MM items than there was about the value added of retrieval items!

<table>
<thead>
<tr>
<th></th>
<th>Split-half correlation coefficient</th>
<th>Spearman-Brown coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>All items</td>
<td>0.54</td>
<td>0.70</td>
</tr>
<tr>
<td>MM items only</td>
<td>0.96</td>
<td>0.98</td>
</tr>
<tr>
<td>retrieval items only</td>
<td>0.34</td>
<td>0.51</td>
</tr>
</tbody>
</table>

Table 22. Reliability estimates using the Spearman-Brown Formula.

Generalisability (external validity)

In section 5.8. the results of demonstrating some of the same MM items in combination with the same CD-i demonstrator to respondents outside KPN, but within the Netherlands, are presented. Most of these respondents have an M&S related function. The corresponding items are related to judgements on the inclusion of video, speech, music and colour photographs in the system. When the results on these four items are compared, a correlation coefficient of 0.36 is found, however, when the colour photograph item is omitted a perfect correlation of 1.0 is found! With regard to the use of colour photographs both groups of respondents judged significantly differently ($p<.05$, t=-2.20, df=32). This is probably due to the fact that the CD-i was presented to the non-KPN respondents to show a teleshop user interface and not to show other M&S possibilities.

5.6.4. Discussion

The null hypothesis that the promotional CD-i, on the basis of the given M&S demonstration, is not seen as useful for M&S by M&S experts is rejected. What does this say about the effectiveness of promotional CD-i's? If the assumption is true that the experts give a valid and reliable judgement, and effectiveness can be equated with 'useful', then a positive answer can be given. In reality, however, there is a long way to go for the CD-i medium. Its penetration is not high enough to justify the already large investments in CD-i marketing applications for consumers. The Tele-CD-i is not yet on the market.
The experts' judgements on the value added of MM elements (H1) and retrieval facilities (H2) were as hypothesised, although the browsing facility was not judged *significantly* above 'neutral'. It seems reasonable to assume that the facilities judged positively, especially video and speech, contribute to the positive judgement about the CD-i as a whole as M&S medium for use by customers. Since the variance for the retrieval items is large and test reliability for these retrieval items is only moderate, the test results with regard to the retrieval items should be handled with some caution. The only exception is hyperlinking.

One possibility to improve the reliability of the test part related to the retrieval items is to increase the sample, which would probably result in more equilibrated sample means for the retrieval items.

If the variance in the answers related to three out of four retrieval items was caused by differences in the level of experience with retrieval facilities another possibility would be to include all four retrieval facilities, also browsing lists and search fields, in the CD-i demo and to confront the respondents more directly with these facilities by letting them play with the CD-i demo themselves, and by performing a usability test with potential users in a usability lab.

5.7. Comparing judgements with regard to the promotional CD-i and the MBC

It is interesting to compare judgements with regard to the promotional CD-i and the MBC, presented in the foregoing sections. Such a comparison is of interest because the same group of experts was involved in both demonstration sessions. A validity threat we should be aware of is an order effect: the MBC session was held first followed by the CD-i session. An alternative to rule out this effect would be to use a true experimental design like a randomised two-group design, however, such designs are often not desirable or feasible in business settings.

<table>
<thead>
<tr>
<th></th>
<th>$\bar{X}_\text{CD-i}$</th>
<th>$\bar{X}_\text{MBC}$</th>
<th>df</th>
<th>pooled var.</th>
<th>t</th>
<th>p&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video</td>
<td>4.50</td>
<td>3.77</td>
<td>28</td>
<td>0.46</td>
<td>2.95</td>
<td>.01</td>
</tr>
<tr>
<td>Speech</td>
<td>4.37</td>
<td>3.57</td>
<td>28</td>
<td>0.77</td>
<td>2.49</td>
<td>.05</td>
</tr>
<tr>
<td>Colour photo</td>
<td>3.87</td>
<td>4.43</td>
<td>28</td>
<td>0.58</td>
<td>-2.04</td>
<td>NS</td>
</tr>
<tr>
<td>Hyperlinking</td>
<td>3.96</td>
<td>4.00</td>
<td>26</td>
<td>0.49</td>
<td>-0.14</td>
<td>NS</td>
</tr>
<tr>
<td>Menu</td>
<td>3.67</td>
<td>3.70</td>
<td>28</td>
<td>0.87</td>
<td>-0.10</td>
<td>NS</td>
</tr>
<tr>
<td>Browsing</td>
<td>3.33</td>
<td>3.67</td>
<td>28</td>
<td>0.79</td>
<td>-1.03</td>
<td>NS</td>
</tr>
<tr>
<td>Search fields</td>
<td>3.60</td>
<td>3.64</td>
<td>27</td>
<td>0.79</td>
<td>-0.13</td>
<td>NS</td>
</tr>
</tbody>
</table>

Table 23. Overview t-test results with regard to judgement differences for the promotional CD-i and the MBC.

It is interesting to note that there is no correlation (.01) between the mean scores in the two test conditions. A two-tailed t-test, to test the hypothesis that the mean scores of both groups
on each variable are equal, revealed that only with regard to two MM elements statistical differences were found. These MM elements are the inclusion of video and the inclusion of speech. With regard to the inclusion of colour photographs clear, but not significant, differences are found.

- Video was more appreciated in a promotional CD-i than in an MBC (t=2.95, df=28, p<.01), this result is highly significant.
- Speech was significantly more appreciated in a promotional CD-i than in an MBC (t=2.49, df=28, p<.05).
- Colour photographs were more appreciated in an MBC than in a promotional CD-i, but this difference is not statistically significant.

In the discussion with the expert panel members it became evident that for promotional purposes on a TV based medium (the CD-i) the use of video and speech is more appropriate than on a PC based medium used in an office environment for the support of sales people (the MBC). Photographs are more fit for the M&S office environment because they do not distract so easily. On a promotional medium, however, they are too static in comparison with video.

It is interesting to note that no clear differences between the two test conditions were found with regard to the inclusion of retrieval facilities.

5.8. A survey of the effectiveness of MM teleshop services

5.8.1. Introduction

The VM service is discussed in chapter 3. The viability of the VM depends largely on the viability of the individual MM teleshop services of information providers, who make use of the general VM service. A number of interviews with information providers offering Videotex information services, and potential investors in information services, were conducted to obtain an indication of the viability of MM teleshop services for information providers.

Based on hypothesis H1, about the value added of MM for M&S in situations where effective information and knowledge transfer is required, it is hypothesised that an MM user interface is judged to be better than a text based interface (H1-1\textsubscript{1}), that the addition of MM elements is judged 'positive' (H1-2\textsubscript{1}), and that MM is judged to be useful for marketing and sales by an information provider (H1-3\textsubscript{1}).

With regard to hypothesis H3, about the viability of MRSs for M&S, it is hypothesised that an MM teleshop is judged to be viable (H3-4\textsubscript{1}), and that this judgement will improve if a longer time horizon is taken (H3-5\textsubscript{1}).

Certain success/risk factors are believed to be relevant (H4). Since the questionnaire is limited only a small selection of success/risk factors were tested (H4-6\textsubscript{1}):

- the importance of the innovative image of an MM teleshop service;
• the importance of the inclusion of automatic payment functionality, related to flexible user support, this is considered to be vital for teleshop services;
• competitive advantage as an argument to develop a teleshop service.

With regard to hypothesis H5, about the (perceived) effectiveness of an MRS for M&S, it is hypothesised that an MM teleshop service is perceived to be effective in terms of meeting the information provider's business objectives (H5-7). Further, it is hypothesised that this judgement will be improved if a longer time horizon is taken (H5-8).

Finally, it is hypothesised that differences will be found between the judgements of experts from experienced, innovative firms that already run a teleshop service, and firms that do not have any experience with setting up and running teleshop services (see demographic hypothesis Hd-9).

<table>
<thead>
<tr>
<th>No</th>
<th>Alternative hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>An MM user interface is judged to be better than a text based interface (e.g., as used in teletext, Videotex or Minitel) by information providers.</td>
</tr>
<tr>
<td>1-2</td>
<td>The addition of an MM element (video, speech, colour pictures, music, animations) is judged positively.</td>
</tr>
<tr>
<td>1-3</td>
<td>MM is judged to be useful for marketing and sales by an information provider.</td>
</tr>
<tr>
<td>3-4</td>
<td>An MM teleshop is judged to be viable by an information provider.</td>
</tr>
<tr>
<td>3-5</td>
<td>The judged longer term viability of an MM teleshop service is higher than the judged shorter term viability of such a service.</td>
</tr>
<tr>
<td>4-6</td>
<td>A success/risk factor (innovative image, inclusion of automatic payment, competitive advantage) is relevant for an MM teleshop service.</td>
</tr>
<tr>
<td>5-7</td>
<td>An MM teleshop service is perceived to be effective in terms of meeting the information provider's business objectives, i.e., extra revenues, new customers, improved margin, ROI, gaining market share, improving quality of service.</td>
</tr>
<tr>
<td>5-8</td>
<td>An MM teleshop service is perceived to be more effective in terms of meeting the information provider's business objectives on the long term rather than on the short term.</td>
</tr>
<tr>
<td>d-9</td>
<td>Judgements made by experienced and non-experienced firms differ.</td>
</tr>
</tbody>
</table>

Table 24. Overview of alternative hypotheses with regard to the economic viability of MM teleshop services for information providers.

5.8.2. Method

A group of eleven respondents from experienced teleshop service companies was approached. Two companies did not wish to co-operate. Next, another group of ten respondents from comparable companies was approached. These companies were comparable in the sense that they operate in the same mix of branches as the experienced group of companies.
The group of respondents (n=19), approached between March and June 1994, consisted of 6 general managers, 6 marketing managers, 3 project leaders, 2 service development staff members, 1 head of information systems, and 1 general management assistant.

The respondents were first confronted with a demonstrator giving an impression of how an MM user interface for an MM teleshop system looks like, during an interview session. The CD-i demonstrator, described previously, was used for this purpose. After this demonstration respondents were asked questions about the MM aspects to test hypotheses H1-x0. Next, respondents were confronted with scenario 1 and questions about viability (H3-x0) and meeting business objectives (H5-x0), and so on for scenario 2 and scenario 3. Finally, they were asked some questions about success/risk factors (H4-x0).

Scenario 1 contains a description of the situation in the year 1994. Scenario 2 contains a description of the situation in the year 1999, and scenario a description of the situation in the year 2004 (see appendix C.6.). Scenario's 2 and 3 are based on extrapolations of current developments, which is always hazardous.

An example of an interval scale used for a question about the value added of MM is given below:

M1. Do you think that this kind of user interface is worse or better than a text based interface like Teletext, Videotex or Minitel?

   Much worse   1----------2-----------3----------4---------5   Much better

An example of a nominal-dichotomous question about the viability of MM teleshop services is:

9. Do you think a multimedia teleshop service is viable for your company today?
   0 Yes  0 No

An example of a question about system effectiveness (meeting business objectives) for scenario '1999' using again an interval scale is:

5. Do you expect to meet the ROI requirement for a multimedia teleshop service for your company in 1999?
   Certainly not   1----------2-----------3----------4---------5   Certainly yes

The use of the interval scale results in the following general format of the H1-1, H1-2, H4-6 and H5-7 null hypotheses and alternative hypotheses:
\[ H_0: u \leq 3 \]
\[ H_1: u > 3 \]

It was expected that the expert estimates would be highly correlated with time in the sense that the mean estimates for the long term (2004) would be higher than the mean estimates for the medium term (1999), and that in their turn the mean estimates for the medium term would be higher than those for the short term (1994). So, the general format for the H5-8 null hypotheses and the alternative hypotheses is:

\[ H_0: u_{1994} \geq u_{1999} \geq u_{2004} \]
\[ H_1: u_{1994} < u_{1999} < u_{2004} \]

The hypothesis H1-3 and H3-4 using a nominal-dichotomous scale (yes/no) can be formulated as hypotheses testing goodness of fit (Kirk, 1978):

\[ H_0: p_{yes} \leq 50\% \]
\[ H_1: p_{yes} > 50\% \]

Where p is the proportion of the respondents scoring yes or no.

Hypothesis H3-5 about the positive relationship of viability expectations (measured on a yes/no scale) with time can be formulated as hypotheses about the equality of proportions (Kirk, 1978):

\[ H_0: p_{yes - 1994} \geq p_{yes - 1999} \geq p_{yes - 2004} \]
\[ H_1: p_{yes - 1994} < p_{yes - 1999} < p_{yes - 2004} \]

The demographic hypothesis Hd-9 with regard to different scores on interval scales can be formulated as:

\[ H_0: u_i = u_n \]
\[ H_1: u_i \neq u_n \]

5.8.3. Results

With regard to the value added of MM it can be concluded from the results, presented in table 26, that the H1-10 and H1-20 hypotheses can be rejected: the addition of MM elements to the user interface of a teleshop service was judged 'positive' (mean of mean
score by respondents: $\bar{X}=4.2$) on all variables and an MM user interface was judged to be better than a text based interface, hence also the mean MM judgements by respondent are significantly above 'neutral' ($t=9.67$, $p<.01$, $\sigma=0.55$, $df=18$).

<table>
<thead>
<tr>
<th>H</th>
<th>Evaluation MM aspects</th>
<th>df</th>
<th>$\bar{X}$</th>
<th>$\sigma$</th>
<th>$t$</th>
<th>$p&lt;$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>M.1. MM user interface better than text based user interface</td>
<td>18</td>
<td>4.58</td>
<td>0.69</td>
<td>9.939</td>
<td>.01</td>
</tr>
<tr>
<td>1-2</td>
<td>M.2. Judging the addition of video negative/positive</td>
<td>18</td>
<td>4.21</td>
<td>0.98</td>
<td>5.404</td>
<td>.01</td>
</tr>
<tr>
<td>1-2</td>
<td>M.3. Judging the addition of speech negative/positive</td>
<td>18</td>
<td>4.16</td>
<td>0.90</td>
<td>5.618</td>
<td>.01</td>
</tr>
<tr>
<td>1-2</td>
<td>M.4. Judging the addition of colour pictures negative/positive</td>
<td>18</td>
<td>4.47</td>
<td>0.84</td>
<td>7.636</td>
<td>.01</td>
</tr>
<tr>
<td>1-2</td>
<td>M.5. Judging the addition of music negative/positive</td>
<td>18</td>
<td>3.68</td>
<td>0.95</td>
<td>3.153</td>
<td>.01</td>
</tr>
<tr>
<td>1-2</td>
<td>M.6. Judging the addition of animations negative/positive</td>
<td>18</td>
<td>4.24</td>
<td>0.75</td>
<td>7.167</td>
<td>.01</td>
</tr>
<tr>
<td>1</td>
<td>Mean score per respondent</td>
<td>18</td>
<td>4.22</td>
<td>0.55</td>
<td>9.673</td>
<td>.01</td>
</tr>
</tbody>
</table>

Table 25. Results of survey with regard to MM aspects measured on an interval scale.

![Multimedia user interface for teleshop service](image)

Figure 48. Judgement on the value added of MM for teleshop services.

<table>
<thead>
<tr>
<th>H</th>
<th>Evaluation MM aspects</th>
<th>df</th>
<th>$\bar{X}$</th>
<th>yes</th>
<th>no</th>
<th>$\chi^2$</th>
<th>$p&lt;$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>M.7. MM is useful for M&amp;S</td>
<td>1</td>
<td>100%</td>
<td>19</td>
<td>0</td>
<td>19.05$^{39}$</td>
<td>.01</td>
</tr>
</tbody>
</table>

Table 26. Results of survey with regard to MM aspects measured on a yes/no scale.

---

$^{39}$The $\chi^2$ statistic used is $\chi^2 = \sum \frac{(O_i - E_i - 0.5)^2}{E_i}$, where $O_i, \ldots, O_k$ represent observed frequencies and $E_i, \ldots, E_k$ represent expected frequencies. Yate's 0.5 correction value is used because each expected frequency does not equal at least 10, given that the degrees of freedom equals one (Kirk, 1978). Since $n=19$, the expected frequencies for the categories 'yes' and 'no' equal in fact 9.5.
All respondents saw MM as useful for M&S (p<.01, χ²=19.05, df=1). This indicates points in the same direction as the results given above.

With regard to scenario '1994' the null hypothesis H5-7₀ cannot be rejected. Respondents did not believe that today an MM teleshop service generates new revenues, improves the margin, helps to reach new customers, meets ROI requirements and helps to gain market share. Only customer service was believed to improve if an MM teleshop service is introduced today (p<.01, t=3.47, σ=1.16, df=18). If we consider the mean scores by respondents, and thus take into account all scores, it cannot be concluded that introducing an MM teleshop service in 1994 is judged to have value added.

<table>
<thead>
<tr>
<th>H</th>
<th>Scenario I: 1994</th>
<th>df</th>
<th>X̄</th>
<th>σ</th>
<th>t</th>
<th>p&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>H5-7 1.1 New revenues by MM teleshop service</td>
<td>18</td>
<td>2.63</td>
<td>1.34</td>
<td>&lt;0</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>H5-7 1.2 How an MM teleshop service affects the margin</td>
<td>18</td>
<td>2.50</td>
<td>1.09</td>
<td>&lt;0</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>H5-7 1.3 Possibility to reach new customers using an MM teleshop service</td>
<td>18</td>
<td>2.74</td>
<td>1.34</td>
<td>&lt;0</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>H5-7 1.4 Expect to meet ROI requirements for MM teleshop service</td>
<td>18</td>
<td>2.13</td>
<td>1.14</td>
<td>&lt;0</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>H5-7 1.5 Expect to gain market share using MM teleshop service</td>
<td>18</td>
<td>3.13</td>
<td>1.26</td>
<td>0.456</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>H5-7 1.6 Expect to improve customer service using an MM teleshop service</td>
<td>18</td>
<td>3.92</td>
<td>1.16</td>
<td>3.467</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>H5-7 Mean score per respondent</td>
<td>18</td>
<td>2.84</td>
<td>0.94</td>
<td>&lt;0</td>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

Table 27. Results of the survey for scenario I.

The null hypothesis H3-4₀ that an MM teleshop service is not judged to be viable cannot be rejected for scenario '1994'. This results points in the same direction as the other '1994' results.

<table>
<thead>
<tr>
<th>H</th>
<th>Scenario I: 1994</th>
<th>df</th>
<th>X̄</th>
<th>yes</th>
<th>no</th>
<th>χ²</th>
<th>p&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.7 Is the scenario realistic</td>
<td>1</td>
<td>79%</td>
<td>15</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H3-4 1.8 An MM teleshop service is viable for your company in 1994</td>
<td>1</td>
<td>21%</td>
<td>4</td>
<td>15</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H3-4 1.9 An MM teleshop service is viable in general</td>
<td>1</td>
<td>11%</td>
<td>2</td>
<td>17</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 28. Results of the survey for scenario I.

Respondents agreed (X̄=4.0) that their company will have an MM teleshop service (p<.01, t=3.82, df=18) by 1999. All item scores are significantly above 'neutral' except two: respondents were 'neutral' (X̄=3.3) about the influence of the MM teleshop service on the company's margin and the respondents were 'neutral' (X̄=3.0) about meeting ROI requirements using the MM teleshop service. If we look at the mean scores by respondent it can be concluded that for scenario '1999' the H5-7₀ hypothesis can be rejected that an MM teleshop is not perceived as effective.
Table 29. Results of the survey for scenario II.

<table>
<thead>
<tr>
<th>H</th>
<th>Scenario II: 1999</th>
<th>df</th>
<th>X</th>
<th>σ</th>
<th>t</th>
<th>p&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>H5-7 II.0 Company will have an MM teleshop in 5 years</td>
<td>18</td>
<td>3.97</td>
<td>1.11</td>
<td>3.819</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>H5-7 II.1 New revenues by MM teleshop service</td>
<td>18</td>
<td>3.84</td>
<td>1.13</td>
<td>3.245</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>H5-7 II.2 How an MM teleshop service affects the margin</td>
<td>18</td>
<td>3.32</td>
<td>0.95</td>
<td>1.455</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>H5-7 II.3 Possibility to reach new customers by an MM teleshop service</td>
<td>18</td>
<td>3.42</td>
<td>1.06</td>
<td>1.735</td>
<td>.05</td>
<td></td>
</tr>
<tr>
<td>H5-7 II.4 Expects to meet ROI requirements for MM teleshop service</td>
<td>18</td>
<td>3.03</td>
<td>0.96</td>
<td>0.119</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>H5-7 II.5 Expects to gain market share by MM teleshop service</td>
<td>18</td>
<td>3.61</td>
<td>0.94</td>
<td>2.817</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>H5-7 II.6 Expects to improve customer service by an MM teleshop service</td>
<td>18</td>
<td>4.21</td>
<td>0.96</td>
<td>5.485</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>H5-7 Mean score per respondent</td>
<td>18</td>
<td>3.63</td>
<td>0.86</td>
<td>3.174</td>
<td>.01</td>
<td></td>
</tr>
</tbody>
</table>

The null hypothesis H3-40 that an MM teleshop service is not judged to be viable can be rejected for scenario '1999' at a significance level α=.01 (see table 30). This result points in the same direction as the other '1999' results.

Table 30. Results of the survey for scenario II.

<table>
<thead>
<tr>
<th>H</th>
<th>Scenario II: 1999</th>
<th>df</th>
<th>X</th>
<th>yes</th>
<th>no</th>
<th>χ²</th>
<th>p&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>II.7 Is the 1994 scenario realistic</td>
<td>1</td>
<td>74%</td>
<td>14</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H3-7 II.8 An MM teleshop service is viable for your company in 1999</td>
<td>1</td>
<td>83%</td>
<td>15</td>
<td>3</td>
<td>8.056</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>H3-4 II.9 An MM teleshop service is viable in general</td>
<td>1</td>
<td>94%</td>
<td>17</td>
<td>1</td>
<td>14.278</td>
<td>.01</td>
<td></td>
</tr>
</tbody>
</table>

Respondents strongly believed (X̄=4.5) that their company will have an MM teleshop service in 2004 (p<.01, t=6.23, df=18). All item scores are significantly above 'neutral'.

Table 31. Results of the survey for scenario III.

<table>
<thead>
<tr>
<th>H</th>
<th>Scenario III: 2004</th>
<th>df</th>
<th>X</th>
<th>σ</th>
<th>t</th>
<th>p&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>H5-7 III.0 Company will have an MM Teleshop in 10 years</td>
<td>18</td>
<td>4.45</td>
<td>1.01</td>
<td>6.232</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>H5-7 III.1 New revenues by MM teleshop service</td>
<td>18</td>
<td>3.89</td>
<td>1.14</td>
<td>3.429</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>H5-7 III.2 How an MM teleshop service affects the margin</td>
<td>18</td>
<td>3.55</td>
<td>0.96</td>
<td>2.520</td>
<td>.05</td>
<td></td>
</tr>
<tr>
<td>H5-7 III.3 Possibility to reach new customers by an MM teleshop service</td>
<td>18</td>
<td>3.61</td>
<td>1.06</td>
<td>2.485</td>
<td>.05</td>
<td></td>
</tr>
<tr>
<td>H5-7 III.4 Expects to meet ROI requirements for MM teleshop service</td>
<td>18</td>
<td>3.71</td>
<td>0.89</td>
<td>3.492</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>H5-7 III.5 Expects to gain market share by MM teleshop service</td>
<td>18</td>
<td>3.63</td>
<td>0.91</td>
<td>3.024</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>H5-7 III.6 Expects to improve customer service by an MM teleshop service</td>
<td>18</td>
<td>4.37</td>
<td>1.00</td>
<td>5.978</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>H5-7 Mean score per respondent</td>
<td>18</td>
<td>3.89</td>
<td>0.80</td>
<td>4.931</td>
<td>.01</td>
<td></td>
</tr>
</tbody>
</table>

at a significance level α=.05 or α=.01. If we look at the mean scores by respondent (X̄=3.9) it can be concluded that for scenario '2004' the H5-70 hypothesis can be rejected that an MM teleshop is not perceived to be effective. So, the economic viability indicators for MM teleshop services are positive.
The null hypothesis H3-40 that an MM teleshop service is not judged to be viable can be rejected for scenario '2004' as well (see table 32) in favour of the alternative hypothesis. This result is in accordance with the other '2004' results.

<table>
<thead>
<tr>
<th></th>
<th>Scenario III: 2004</th>
<th>df</th>
<th>X</th>
<th>yes</th>
<th>no</th>
<th>$\chi^2$</th>
<th>p&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-4</td>
<td>III.7 Is the 2004 scenario realistic</td>
<td>1</td>
<td>58%</td>
<td>11</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>III.8 An MM teleshop service is viable for your company in 2004</td>
<td>1</td>
<td>94%</td>
<td>17</td>
<td>1</td>
<td>14.278</td>
<td>.01</td>
</tr>
<tr>
<td>3-4</td>
<td>III.9 An MM teleshop service is viable in general</td>
<td>1</td>
<td>100%</td>
<td>18</td>
<td>0</td>
<td>18.056</td>
<td>.01</td>
</tr>
</tbody>
</table>

Table 32. Results of the survey for scenario III.

![Comparing scenario's by item](image)

Figure 49. Comparing the outcomes for the three scenario's by item and by mean scores by respondent.

As discussed above, it was found that the respondents had a positive judgement about the value added of MM for M&S and teleshopping. When asked if they see an MM teleshop service as a useful additional marketing instrument, the mean response ($\bar{X}$=4.1) was significantly above 'neutral' (p<.01, t=5.072, df=18) (see table 33).

<table>
<thead>
<tr>
<th></th>
<th>General</th>
<th>df</th>
<th>X</th>
<th>$\sigma$</th>
<th>t</th>
<th>p&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>G.1 An MM teleshop service is a useful additional marketing instrument</td>
<td>18</td>
<td>4.13</td>
<td>1.00</td>
<td>5.072</td>
<td>.01</td>
</tr>
<tr>
<td>4-6</td>
<td>G.2 Importance of the innovative image of an MM teleshop service</td>
<td>18</td>
<td>3.71</td>
<td>1.23</td>
<td>2.587</td>
<td>.01</td>
</tr>
<tr>
<td>4-6</td>
<td>G.3 Importance of inclusion of automatic payment functionality</td>
<td>18</td>
<td>4.47</td>
<td>0.75</td>
<td>8.739</td>
<td>.01</td>
</tr>
<tr>
<td>4-6</td>
<td>G.4 Importance if competitors offer teleshop service</td>
<td>18</td>
<td>4.03</td>
<td>1.09</td>
<td>4.226</td>
<td>.01</td>
</tr>
</tbody>
</table>

Table 33. Outcomes of some general questions.

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Chapter 5. Testing Hypotheses

With regard to the selected success/risk factors, innovative image, inclusion of automatic payment functionality, and competitors offering teleshop services, the conclusion is that all three were seen as important ($\bar{X}$ is about 4). The results are all highly significant (p<.01) (see table 33).

**Group differences**

If we look at group differences on almost all variables no significant differences were found, and therefore the null hypothesis $H_0$ cannot be rejected. Only for the question (M.4) about the addition of colour pictures to a teleshop user interface were Videotex experienced companies significantly more positive (4.9) than non-experienced companies (4.1). Since there are no significant differences on the other 39 questions of the questionnaire (see appendix C.6.), and as a consequence there are no differences on the mean outcomes for the MM items, and items of scenario I, II and III (see table 34), it seems reasonable to conclude that the attitudes of both groups with regard to MM teleshopping do not differ significantly as a whole.

<table>
<thead>
<tr>
<th>Question</th>
<th>$\bar{X}_{\text{Group I}}$</th>
<th>$\bar{X}_{\text{Group II}}$</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.4</td>
<td>4.9</td>
<td>4.1</td>
<td>17</td>
<td>2.26</td>
<td>.05</td>
</tr>
<tr>
<td>Mean M</td>
<td>4.3</td>
<td>4.2</td>
<td>17</td>
<td>0.60</td>
<td>NS</td>
</tr>
<tr>
<td>Mean I</td>
<td>3.6</td>
<td>3.6</td>
<td>17</td>
<td>0.72</td>
<td>NS</td>
</tr>
<tr>
<td>Mean II</td>
<td>3.6</td>
<td>3.6</td>
<td>17</td>
<td>-0.04</td>
<td>NS</td>
</tr>
<tr>
<td>Mean III</td>
<td>3.8</td>
<td>4.0</td>
<td>17</td>
<td>-0.35</td>
<td>NS</td>
</tr>
</tbody>
</table>

Table 34. Test outcomes with regard to differences between respondents from experienced (group I) and nonexperienced (group II) teleshopping companies.

**Time horizon and viability**

As expected (H5-8), the mean outcome for scenario 2004 is larger than the mean outcome for scenario 1999, which in its turn is larger than the mean outcome for scenario 1994 (see figure 49). Are these results significant? On the basis of an ANOVA the H5-80 null hypothesis can be rejected (p<.01, F=7.40, df=56) that an MM teleshop service is not perceived to be more effective on the longer term than on the shorter term. This result can be contributed solely to the differences between '1994' and '1999'.

If we consider hypothesis H3-51 about the positive relationship between expected viability and time horizon, the long term viability is higher than the short term viability, we can conclude from the observed (O) frequencies that developments are in the direction hypothesised (see tables 35 and 36).
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<table>
<thead>
<tr>
<th>Time horizon</th>
<th>1994</th>
<th>1999</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>viable for company</td>
<td>O=4</td>
<td>O=15</td>
<td>O=17</td>
</tr>
<tr>
<td></td>
<td>E=12</td>
<td>E=12</td>
<td>E=12</td>
</tr>
<tr>
<td>not viable for company</td>
<td>O=15</td>
<td>O=3</td>
<td>O=1</td>
</tr>
<tr>
<td></td>
<td>E=6.33</td>
<td>E=6.33</td>
<td>E=6.33</td>
</tr>
</tbody>
</table>

\( n = 55 \)

Table 35. Viability for the company and time horizon

The null hypothesis that the proportions viable for the company/not viable for the company are equal, or viability shrinks relatively from '1994' to '2004', can be rejected (\( p < .01, \chi^2 = 26.28, df=2 \)).

<table>
<thead>
<tr>
<th>Time horizon</th>
<th>1994</th>
<th>1999</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>viable in general</td>
<td>O=2</td>
<td>O=17</td>
<td>O=18</td>
</tr>
<tr>
<td></td>
<td>E=12.33</td>
<td>E=12.33</td>
<td>E=12.33</td>
</tr>
<tr>
<td>not viable in general</td>
<td>O=17</td>
<td>O=1</td>
<td>O=0</td>
</tr>
<tr>
<td></td>
<td>E=6</td>
<td>E=6</td>
<td>E=6</td>
</tr>
</tbody>
</table>

\( n = 55 \)

Table 36. Viability in general and time horizon

The null hypothesis that the proportions viable in general/not viable in general are equal, or viability shrinks relatively from '1994' to '2004', can also be rejected (\( p < .01, \chi^2 = 43.36, df=2 \)).

Reliability and validity

Two types of reliability estimates were computed: Cronbach's coefficient \( \alpha \) for item homogeneity and the Spearman-Brown estimate using the split-half correlation coefficient. The Spearman-Brown coefficient is consistently about 0.9, which means that the test reliability is satisfactory. The high coefficient \( \alpha \)'s for the items of the three scenarios indicate that they are probably measuring the same construct ('economic viability'?); thus, the scenario mean is probably a meaningful measure. With regard to the MM items item-homogeneity is still high enough to justify an MM mean measure.

A special kind of face validity estimate was assessed by asking respondents for every scenario whether they believed the scenario presented was realistic or not. Scenario '1994' was seen as realistic by 79% of the respondents, scenario '1999' by 74% of the respondents, and scenario '2004' by only 58% of the respondents; from this it can be concluded that the validity of scenario '2004' was the most doubted. This is not surprising, as it is hard to give
valid forecasts over long time periods. It would perhaps be better not to use scenarios more than five years in the future.

<table>
<thead>
<tr>
<th></th>
<th>Split-half correlation coefficient</th>
<th>Spearman-Brown coefficient</th>
<th>Cronbach's coefficient α</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM items</td>
<td>0.78</td>
<td>0.87</td>
<td>0.72</td>
</tr>
<tr>
<td>Scenario '1994'</td>
<td>0.87</td>
<td>0.93</td>
<td>0.86</td>
</tr>
<tr>
<td>Scenario '1999'</td>
<td>0.85</td>
<td>0.92</td>
<td>0.93</td>
</tr>
<tr>
<td>Scenario '2004'</td>
<td>0.87</td>
<td>0.93</td>
<td>0.91</td>
</tr>
</tbody>
</table>

Table 37. Spearman-Brown reliability estimates and coefficient α estimates for item homogeneity.

5.8.4. Discussion

It is interesting that the respondents see providing MM teleshop services in about five years as viable for their company and viable in general, and in about ten years as economically effective as well. It is also remarkable that providing MM teleshop services is believed to be viable even before it is economically effective! 'You must lose a fly to catch a trout'; the explanation is probably that investments in MM teleshopping are made to meet other objectives than quick ROI, probably long term gains are foreseen in terms of market share, customer satisfactions, etc.

As expected, the respondents see MM teleshopping as more viable and effective in the long term than the short term. This may indicate that there will come a time that MM teleshop services will be widely accepted, but history gives sufficient examples of new technologies that fail to meet high expectancies. We can conclude from this that there is a high potential viability after 5-10 years.

The respondents show a positive attitude with respect to an MM user interface. This result is consistent with the MM paradigm, and hypothesis H1 about the value added of MM for M&S.

It is very interesting that there are no real differences between the attitudes of experienced teleshop service providers and non-experienced teleshop providers. The explanation can be that experiences with Videotex are not so positive, because of a too little dissemination of use, to stimulate further action. Another concurrent explanation based upon the dialectics of progress would be that the leading edge of experienced companies disappeared because competitors learned from their mistakes and that new technologies have arrived, that are new for both groups.

5.9. Market research and viability

If MRSs for M&S are viable and the viability of VM tele-applications is increasing, as can be derived from hypothesis H3, this should be reflected in developments with regard to market volume. Revenues from MRSs for M&S and underlying MM and MR technology
The Viability of Multimedia Retrieval Systems for Marketing and Sales

should show an increase. This section therefore gives a short review of market research findings.

Positive indications for the viability of the MBC, Sales Assistant and MPS are respectively:

- Harlaar & Van Pelt (1994) expect the revenues from interactive catalogues to grow from less than HFL 1 million in 1993 to HFL 5 million in 1996 in the Netherlands.40
- Harlaar & Van Pelt (1993, 1994) expect the revenues in the Netherlands from investment in Points Of Sales to raise from HFL 0.9 million in 1993 to HFL 3.9 million in 1994, and to HFL 8.1 million in 1996. Thus, the mean growth percentage is 120%!
- The results of an n=53 survey of the applicability of CD-i by Explainer (1994) indicate that a majority of 56% of the respondents saw business presentations as a useful application possibility for CD-i; 44% doubted the applicability or saw it as irrelevant; and 74% of the respondents saw it as useful for product presentations. A threat to validity is that of 228 persons approached, selected from a database of 1200 of the largest advertisers in the Netherlands, only a small group was actually willing to participate, so the sample is probably not random.
- Harlaar & Van Pelt (1994) expect the revenues from presentation systems to grow from HFL 5 million in 1993 to HFL 12 million in 1996.

With regard to the viability of the VM it is important to note that:

- Telecommunication company service revenues from Multimedia PCs in Europe and the USA have grown from $1 million in 1992 to $2 million in 1993. Around 2000 the revenues are estimated to be more than $1 billion. (Jeffcoate et al., 1993).
- An annual growth of 50% in MM telecommunication is expected by Systems Dynamics (1993).
- Total interactive TV revenues have grown from $355 million in 1989 to $934 million in 1993, and are expected to grow to $1,753 million in 1996 (Frost & Sullivan Inc., 1993).
- The number of Internet host computers is doubling every year (Carlier, 1994); the total number of host computers was over 1 million and the total number of users was over 15 million in December 1993. In 1993 the commercial use of Internet was about 29% of total Internet use and is expected to become the largest use category in 1994, even larger than the use by research institutes which accounted for 48% of the total Internet use in 1993. The number of commercial sites has grown with more than 750% from 1991 to 1993 (Poole, 1993).

Two points can be made with regard to revenues from MM equipment. First, if MRSs in general are becoming increasingly viable, this should be reflected in the growing revenues of suppliers of MM equipment. Second, the presence of access terminals at home and in the office is a prerequisite for a large-scale introduction of VM services.

401 US Dollar = 1.76 HFL (September 2, 1994).
Chapter 5. Testing Hypotheses

- The number of MM PCs on business sites is expected to grow from under 1 million in 1991 to over 30 million in 1997 (Jeffcoate et al., 1992). The number of MM PCs in the business market in the Netherlands will increase, according to IDC, from 0.5 million in 1993 to 1.5 million in 1995 (Vermeulen et al., 1993).
- North American sales of video codecs have increased from $82.3 million in 1986 to $127.8 million in 1993, and is expected to increase to $155.4 million in 1996 (Frost & Sullivan, 1993).
- Total revenues from desktop MM systems has grown from $47 million in 1992 to $443 million in 1994 in Europe, and from $75 million in 1992 to $497 million in 1994 in the USA. OVUM predicts an ongoing annual growth of 100% (Jeffcoate et al., 1993).
- Total consumer expenditure on MM hardware in Europe and the USA is expected to grow from $135 million in 1992, to $289 million in 1993, $572 million in 1994, and more than $3 billion in 1997. Total consumer expenditure on MM software in Europe and the USA is expected to raise from $253 million in 1992, to $517 million in 1993, $987 million in 1994, to about $5 billion in 1997 (Jeffcoate et al., 1993).
- Total MM revenues in the Netherlands have grown from HFL 33 million in 1992 to HFL 56 million in 1994; the mean annual growth percentage is 29% (Harlaar & Van Pelt, 1993).

If MRS in general are increasingly viable, this should also be reflected in improving market figures for MR technology.
- OVUM (Jeffcoate et al., 1992) forecasted a growth in revenues from data access, including databases and hypermedia, for Europe and the USA from $2 million in 1991 to $10 million in 1992, $42 million in 1993, and even to $1.6 billion in 1997.
- The following year, OVUM (Jeffcoate et al., 1993) adjusted their forecasts downward, but still expected supplier revenues from databases and information access to total less than $1 million in 1992, about $6 million in 1993, $47 million in 1994, and $1.2 billion in 1997.
- OVUM (Jeffcoate et al., 1993) estimates supplier revenues from MM servers (files servers and video servers) to be $8 million in 1992 and $138 million in 1994 in Europe and the USA. Ongoing growth is predicted.

We can conclude from this that all market growth indications and market forecasts are in the expected direction, and thus we can falsify the null-hypotheses that revenues from MRSs for M&S and underlying MM and MR technology do not show an increase. In almost all cases market growth percentages of at least two figures are given. So, MRSs for M&S are probably increasingly viable. Yet, we must be cautious with these indications and forecasts. The drawback of MM market forecasts is given in section 5.4.3.: they all predict growth, but sometimes at a completely different pace.
5.10. A retrospective Cost Benefit Analysis of the IECT Photo Archive

5.10.1. Introduction

The MCA is presented in chapter 3. The results of a Cost Benefit Analysis (CBA) and computation of ROI (with regard to ROI see for example Van Oirsouw et al., 1993) for the IECT photo archive are described in this section, which were used to test the null hypothesis that an MCA is not effective (derived from H5) and to give an indication of the economic viability of an MCA (see H3). The IECT photo archive is a limited implementation of the MCA. The CBA was performed retrospectively, which had the advantage over a prospective CBA that the real costs, and some of the real benefits could be calculated instead of just forecasted costs and benefits.

The CBA is an operationalisation of the variable, *system effectiveness*, in terms of meeting business objectives. It is assumed that if a system has significantly higher benefits than costs, and if this is perceived by the users and management concerned, that the system is highly viable.

The CBA was conducted in close co-operation with the financial analysts of IECT.

<table>
<thead>
<tr>
<th>Type of costs</th>
<th>Costs in HFL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed costs</td>
<td></td>
</tr>
<tr>
<td>Salary administrator</td>
<td>64,000</td>
</tr>
<tr>
<td>Rent (20 m² * HFL 413.-)</td>
<td>8,000</td>
</tr>
<tr>
<td>Facility costs</td>
<td>5,000</td>
</tr>
<tr>
<td>Training</td>
<td>3,500</td>
</tr>
<tr>
<td>Maintenance of 2 work places</td>
<td>8,000</td>
</tr>
<tr>
<td>Other costs</td>
<td>20,000</td>
</tr>
<tr>
<td>Software development (HFL 60,000.- in 3 years)</td>
<td>20,000</td>
</tr>
<tr>
<td>Maintenance of software</td>
<td>20,000</td>
</tr>
<tr>
<td>Hardware investments (HFL 132,000.- in 3 years)</td>
<td>44,000</td>
</tr>
<tr>
<td>Variable costs</td>
<td></td>
</tr>
<tr>
<td>No. of reproductions(^{41})</td>
<td>Costs/reproduction</td>
</tr>
<tr>
<td>2,000</td>
<td>47.50</td>
</tr>
<tr>
<td><strong>ANNUAL EXPLOITATION COSTS</strong></td>
<td>287,500</td>
</tr>
</tbody>
</table>

Table 38. Computation of exploitation costs

\(^{41}\)The number of reproductions is the number of (slide) copies that need to be produced for customers of the IECT photo archive.
5.10.2. Results

The costs are the most easy part of a retrospective CBA. If no additional investments are going to be made the total exploitation costs per year were HFL 287,500.- (see table 38). There were approximately 12,500 photographs or slides stored in the IECT archive at the end of 1993, and there were about 4800 deliveries of photographs or slides per year. So, the total costs per photograph/slide and the total costs per delivery were HFL 23.00 and HFL 59.90 respectively (see table 39).

<table>
<thead>
<tr>
<th>Number of photographs/slides:</th>
<th>12,500</th>
<th>Total costs per photograph/slide:</th>
<th>23.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of deliveries:</td>
<td>4,800</td>
<td>Total costs per delivery:</td>
<td>59.90</td>
</tr>
</tbody>
</table>

Table 39. Overview of costs per photograph and delivery

The identified benefits were grouped into three main categories: efficiency, productivity, and effectiveness (see table 40). The most important efficiency gain was savings in costs for producing new photographic material. The gains were estimated to be about HFL 2,000,000.- a saving on annual costs, copyright prevention claims (hard to estimate), savings in hidden picture management costs (hard to estimate), shorter search times (from days to minutes).

Productivity gains were seen as a welcome side effect. The availability of access to a complete and topical photo archive stimulated the re-use of photographs. At the level of the archive it led to more database requests and deliveries. At the level of IECT it led to more free publicity, which supports the PR function of the IECT. Free publicity can be gained for example by publishing photographs in educational books, telecommunication articles, etc. At the level of PTT Telecom, the more productive archive is believed to have led to more advertisement and indirectly to more sales.

With regard to effectiveness benefits, the implementation of quality control on photographs/slides was seen as very important. Quality control can be seen as part of the operationalisation of corporate image control. Quality control was believed to lead to a better and more balanced choice of advertisement photographs. Such an improved choice of photographs was seen as more effective for advertisement. The possibility for advertising agencies and marketing units to browse through the photo archive and to review successful old photographs, was believed to improve the quality of newly produced photographs.

The most important meaningfulness benefit of the IECT photo archive was increased insight into quality of service, quality of information, use of information and archiving and retrieval costs. It was also felt by the IECT that the archive adds functionality to the IECT, and helps to safeguard the future of the unit.
<table>
<thead>
<tr>
<th>Efficiency</th>
<th>PTT Telecom</th>
<th>IECT</th>
<th>IECT photo archive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) HFL 2,000,000.00 saving in photographic production annual costs</td>
<td></td>
<td>Economy of scale advantages:</td>
</tr>
<tr>
<td></td>
<td>b) Prevention of copyright claims</td>
<td></td>
<td>a) Discounts in slide reproduction costs</td>
</tr>
<tr>
<td></td>
<td>c) Saving in hidden photo management costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) Reduction of necessary search time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productivity</td>
<td>a) More advertisement</td>
<td>a) More free publicity</td>
<td>a) More database requests</td>
</tr>
<tr>
<td></td>
<td>b) More sales</td>
<td></td>
<td>b) More deliveries</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>a) Better retention of brand and company name</td>
<td>a) Operationalisation of corporate image control</td>
<td>a) High topicality of database</td>
</tr>
<tr>
<td></td>
<td>b) Improved communication of the Unique Selling Position</td>
<td></td>
<td>b) Short delivery times</td>
</tr>
<tr>
<td></td>
<td>c) Improved response rate to marketing campaigns</td>
<td></td>
<td>c) Quality control</td>
</tr>
<tr>
<td>Meaningfulness⁴²</td>
<td>a) Better and more balanced choice of advertisement photos</td>
<td>a) Insight into quality of service, quality of information, use of information and costs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Improved quality of new photo productions</td>
<td></td>
<td>b) Higher level of (commercial) knowledge of photo archiving and photo retrieval</td>
</tr>
<tr>
<td></td>
<td>c) Improved corporate (self-) image as an innovative company</td>
<td></td>
<td>c) Safeguarding the future of the unit</td>
</tr>
</tbody>
</table>

Table 40. Overview of efficiency, productivity, effectiveness and meaningfulness benefits at the level of PTT Telecom, IECT and the IECT photo archive.

⁴²Meaningfulness is the remaining benefits category, meaningful in that these benefits are often believed to contribute indirectly to an organisation's efficiency, productivity and effectiveness objectives.
Evaluation

The estimated annual cost savings related to reduced production of new photographic material are:

\[ AS = (SR \times \overline{RC}) - CAC \]

Where \( AS \) is the estimated annual savings, \( CAC \) is the current annual exploitation costs, \( \overline{RC} \) is mean replacement costs, \( SR \) is the estimated saved number of replacements, and \( OAC = (SR \times \overline{RC}) \) is the estimated annual costs in the old situation.

The estimated annual costs in the old situation (OAC) are operationalised in a rather restricted manner; because of the impreciseness of the estimations only the major old costs were taken into account, namely the replacement costs in the old situation.

This leads us to the following outcome of estimated annual savings:

\[ AS = (2,000 \times 1,000) - 287,500\text{-} = 1,712,500\text{-}. \]

The obvious conclusion is that the perceived estimated annual savings are considerable, and justify the investment. If Return On Investment was the criterion, ROI would be about 900% (ROI = (AS/Initial investment)*100 = (1,712,500 / 192,000\text{-}) * 100 = 892%)

The weaknesses of the evaluation given above based on the CBA, are that the evaluation is:

- incomplete: not all the benefits and savings are quantified (or quantifiable);
- not accurate: the exact replacement costs in the old situation are unknown.

Despite these weaknesses these outcomes were accepted by the management of IECT and PTT Telecom. The value added of a more detailed and valid evaluation are not believed to outweigh the research costs for more completeness and more accuracy. It also seems highly probable that more complete and more accurate information would not influence the decision to proceed with the implementation of the MCA.
<table>
<thead>
<tr>
<th>Output</th>
<th>Slide delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>Advertisement photo management</td>
</tr>
<tr>
<td>Description</td>
<td>This task encompasses the advertisement photo archiving and retrieval as performed by IECT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre</th>
<th>Norm (target)</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management costs per delivery</td>
<td>Unknown</td>
<td>HFL 59.90</td>
<td></td>
</tr>
<tr>
<td>Annual photo management costs</td>
<td>Unknown</td>
<td>HFL 287,500</td>
<td></td>
</tr>
<tr>
<td>Number of deliveries</td>
<td>Not applicable</td>
<td>As many as wished</td>
<td>4,800</td>
</tr>
<tr>
<td>Delivery time</td>
<td>Irregular (sometimes weeks)</td>
<td>3-4 days</td>
<td>3-4 days</td>
</tr>
<tr>
<td>Number of requests</td>
<td>Not applicable</td>
<td>As many as wished</td>
<td>&gt;4,800</td>
</tr>
<tr>
<td>Topicality of database</td>
<td>0-10%</td>
<td>100%</td>
<td>90%</td>
</tr>
<tr>
<td>Quality control</td>
<td>Not implemented</td>
<td>Implemented</td>
<td>Implemented</td>
</tr>
<tr>
<td>Search time</td>
<td>Long (within days)</td>
<td>Short (within minutes)</td>
<td>Short (within minutes)</td>
</tr>
</tbody>
</table>

Table 41. Comparison of the old situation with the new situation on a number of variables

5.10.3. Discussion

This case shows that the positive outcome of the CBA, based solely on easy to quantify efficiency gains, is used to justify the investment. The ROI of 900% is convincing! If the CBA and ROI computation are valid H5, i.e., that MCAs are not effective, can be falsified. This gives a positive indication for the viability of this MCA.

The non-quantified effectiveness gains were also qualified as extremely important, and had an influence on the management decision to invest in the MCA. So, a CBA and ROI are only, in a limited sense indicators of system viability. The problem remains how to quantify effectiveness gains in a valid and reliable way.

5.11. A prospective Cost Benefit Analysis of an MBC for tele-ordering by Top 1000 accounts

5.11.1. Introduction

A prospective CBA is performed and ROI is computed in this section to test the null hypothesis that an MBC is not effective (derived from H5) and to give an indication of the viability of an MBC (see H3). The potentially most profitable application of an MBC in the short term was looked for together with marketing managers from PTT Telecom Business Market. The conclusion of this thought process was that an MBC should be provided to large (Top 1000) accounts for processing their small orders. Therefore the MBC should include tele-ordering functionality. The reasons for the focus on tele-ordering is that this
makes it possible to recover the costs by more efficient order intake and order handling, and probably extra turnover. The reasons for the focus on the small order market is that it is believed that only small orders will be ordered using a tele-order system; large orders will require a more personal approach. The first reason for the selection of large accounts is that the central purchasing departments of these, limited number, of customers place a high volume of small orders, so only a small number of MBC access points is enough to cover a relatively large part of the PTT Telecom small order market. The second reason for the selection of large accounts is that it is within reach to create a win-win situation since the large accounts can save money by extra discounts, and by the more efficient purchase of small, standard telecommunication products.

Tele-ordering has the additional advantages for the sales organisation that:
• customer relations are improved, securing a market share;
• experience is gained with providing MM tele-ordering services.

Additional customer advantages are
• faster ordering;
• customised offers.

When introducing an MBC for tele-ordering by large accounts some problems are anticipated. One problem is that some customers probably do not want to co-operate, for example, because they fear being bound to one supplier. Another problem can be that a large account does not have a centralised purchase department that orders all telecommunication products.

The results of the CBA and the computations of ROI are given in the next section.

5.11.2. Results

First, it seems useful to discuss two variants on initial investments and system costs for the sales organisation (see table 42).

<table>
<thead>
<tr>
<th>ANNUAL SYSTEM COSTS</th>
<th>Per update</th>
<th>Initial</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production costs for an application on CD-ROM</td>
<td>50,000</td>
<td>50,000</td>
<td></td>
</tr>
<tr>
<td>Reproduction costs (circulation 1000)</td>
<td>10,000</td>
<td>10,000</td>
<td></td>
</tr>
<tr>
<td>Distribution costs</td>
<td>3,000</td>
<td>3,000</td>
<td></td>
</tr>
<tr>
<td>Gross salary costs for 4 employees</td>
<td>360,000</td>
<td>360,000</td>
<td></td>
</tr>
<tr>
<td>Depreciation on equipment for own use</td>
<td></td>
<td>30,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Depreciation on interface to teleorder database</td>
<td></td>
<td>100,000</td>
<td>33,333</td>
</tr>
<tr>
<td>Depreciation on customer equipment</td>
<td></td>
<td>1,000,000</td>
<td>333,333</td>
</tr>
<tr>
<td>TOTAL (including customer equipment)</td>
<td>423,000</td>
<td>(a1) 1,130,000</td>
<td>(a2) 799,667</td>
</tr>
<tr>
<td>TOTAL (excluding customer equipment)</td>
<td>423,000</td>
<td>(b1) 130,000</td>
<td>(b2) 466,333</td>
</tr>
</tbody>
</table>

Table 42. Overview of annual system costs.
In the first variant (a1) the initial investment is HFL 1,130,00. This includes equipment for internal use, investment in a tele-order system interface to an existing order database and investment in MBC access points. It is assumed that one MBC access point per customer is sufficient, physically located in the central purchasing department of the customer. If the costs for customer equipment are covered by the sales organisation, and the equipment costs per access point are HFL 1,000, than the initial investment in customer equipment is HFL 1,000,000.

In the second variant (b1) the costs for customer equipment are not covered by the sales organisation but by the customer.

The annual system costs have two major cost components: depreciations on investments over 3 years, and costs for producing and maintaining the MBC tele-order service. With regard to the production costs of an MBC, it is assumed that one update per year suffices and that the software is reproduced and distributed on CD-ROM. There are two annual system cost variants: one including depreciation on customer equipment (a2) and one excluding depreciation on customer equipment (b2). Finally, it is important to say that system costs are not expected to vary very much with the volume of tele-orders processed by the MBC tele-ordering system.

Second, it is important to discuss the three cost/benefit scenarios elaborated (see table 43).

<table>
<thead>
<tr>
<th>Scenario 1: conservative</th>
<th>Scenario 2: optimistic</th>
<th>Scenario 3: very optimistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean annual revenues by telesales as % of annual turnover</td>
<td>Mean extra annual revenues by telesales as % of annual turnover</td>
<td></td>
</tr>
<tr>
<td>1%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>

Table 43. Overview of the conservative, optimistic and very optimistic scenarios.

- **Scenario 1**: the percentage of the annual turnover processed by the tele-order system is 1% and the tele-order system does not generate extra turnover. Scenario 1 is the most conservative scenario. (The annual turnover for small orders in the business market equals HFL 242,000,000. This figure is based on the measurement period May 1993-May 1994. Percentages are based on this figure).
- **Scenario 2**: the percentage of the annual turnover by the tele-order system is 5% and the tele-order system generates annual 1% extra revenues. Scenario 2 is an optimistic scenario, probably only realistic in the middle term.
- **Scenario 3**: the percentage of the annual turnover by the tele-order system is 10% and the tele-order system generates 5% extra annual revenues. Scenario 3 is a very optimistic scenario, probably only realistic in the long term. To compare, telephone sales outlets have about an 8% share of the annual turnover, today.
Third, the total annual system costs were computed for the two variants and the three scenarios (see table 44).

<table>
<thead>
<tr>
<th>ANNUAL COSTS</th>
<th>MBC cost scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a=a2) TOTAL ANNUAL SYSTEM COSTS (incl.)</td>
<td>799,667</td>
</tr>
<tr>
<td>(b=b2) TOTAL ANNUAL SYSTEM COSTS (excl.)</td>
<td>466,333</td>
</tr>
<tr>
<td>(c) Annual extra costs due to extra sales transactions</td>
<td>0 1,210,000</td>
</tr>
<tr>
<td>(d=a+c) TOTAL ANNUAL COSTS (incl.)</td>
<td>799,667</td>
</tr>
<tr>
<td>(e=b+c) TOTAL ANNUAL COSTS (excl.)</td>
<td>466,333</td>
</tr>
</tbody>
</table>

Table 44. Overview of total annual costs including/excluding investment in customer equipment for the three scenarios.

There are two cost components: the two variants of the total annual system costs are assumed to be constants for reasons of simplicity; the annual extra costs due to extra sales transactions generated by the MBC. It is assumed that the annual extra costs cover 50% of the transaction values. The six total annual cost outcomes (2 variants * 3 scenarios) range from about HFL 466,000,- to about HFL 6,850,000,-.

Fourth, the next step is to compute, for the three scenarios, the annual benefits (see table 45).

<table>
<thead>
<tr>
<th>ANNUAL BENEFITS</th>
<th>MBC benefit scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savings on telephone sales costs</td>
<td>110,880</td>
</tr>
<tr>
<td>Savings on consumer shop sales costs</td>
<td>7,920</td>
</tr>
<tr>
<td>Savings on business shop sales costs</td>
<td>93,600</td>
</tr>
<tr>
<td>Savings on personal sales</td>
<td>307,200</td>
</tr>
<tr>
<td>Extra annual turnover by MBC teleordering</td>
<td>0 2,420,000</td>
</tr>
<tr>
<td>(f) TOTAL ANNUAL BENEFITS</td>
<td>519,600</td>
</tr>
</tbody>
</table>

Table 45. Overview of total annual benefits for the three scenarios.

Two main categories of benefits are distinguished: savings on sales costs by other sales outlets and extra annual turnover by the MBC tele-order system. The savings are made from avoided salary costs. The gross salary costs related to small orders for business customers for the telephone sales outlet, consumer shops, business shops and personal sales outlets are respectively about HFL 11,088,000,-, HFL 792,000,-, HFL 9,360,000,- and HFL 30,720,000,-. The avoided salary costs were computed by taking the percentage of annual turnover in the first column of table 43. To consider seriously other sales outlet cost savings seems too optimistic.
Fifth, the annual profits and ROI were computed for the three scenarios and two cost variants (see table 46).

<table>
<thead>
<tr>
<th>ANNUAL PROFITS AND ROI</th>
<th>MBC profit scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>TOTAL ANNUAL PROFITS (incl)</td>
<td>-280,067</td>
</tr>
<tr>
<td>TOTAL ANNUAL PROFITS (excl)</td>
<td>53,267</td>
</tr>
<tr>
<td>ROI (incl)</td>
<td>-25%</td>
</tr>
<tr>
<td>ROI (excl)</td>
<td>41%</td>
</tr>
</tbody>
</table>

|                        | 2                   |
| TOTAL ANNUAL PROFITS (incl) | 3,008,333         |
| TOTAL ANNUAL PROFITS (excl) | 3,341,667         |
| ROI (incl)             | 266%                |
| ROI (excl)             | 2,571%              |

|                        | 3                   |
| TOTAL ANNUAL PROFITS (incl) | 10,446,333        |
| TOTAL ANNUAL PROFITS (excl) | 10,779,667        |
| ROI (incl)             | 924%                |
| ROI (excl)             | 8,292%              |

Table 46. Overview of total annual profits and ROI for the three scenarios and two cost variants.

The total annual profits (benefits-costs) range from about HFL -280,000,- in the pessimistic scenario including depreciation of customer equipment to about HFL 10,780,000,- in the very optimistic scenario excluding depreciation of customer equipment. The results for the variant including investment in customer equipment are displayed graphically in figure 50.
ROI varies from -25% to 924% if investment in customer equipment is included and from 41% to an unbelievable 8,292% if investment in customer equipment is excluded.

5.11.3. Discussion

What can we conclude from all this? What we can conclude from this is that, if the cost and benefit assumptions underlying the CBA and ROI computation are correct, there is a great potential for the MBC even if relatively small percentages of small orders are processed by the MBC. We can falsify hypothesis H5Q, that an MBC is not effective, only for the two more optimistic scenarios and for the conservative scenario if investment in customer equipment can be avoided.

In the case where a very conservative, low profile scenario is followed the MBC is only viable if enough customers are interested in investing in their own equipment. Customers can be persuaded to do this if they see clear benefits: discounts and efficiency gains. In the case where more optimistic scenarios are followed, in which one aims at higher percentages of the small order market, a more aggressive approach is necessary to ensure that enough customers will use the MBC. Their co-operation is harder to get if the equipment costs have to be covered by the customer. So, in this case it seems inevitable that the sales organisation needs to cover customer equipment costs.

In general, one can conclude from this example that MBC like tele-order systems form an interesting alternative for more conventional sales outlets. The driving forces behind such a development are a) saving sales outlet costs and b) securing and improving a market position.

5.12. Summary

H1. Judgements on the value added of MM.

- The user friendliness of an IS improves by MM.
- An MM interface is better than a textual one for teleshopping.
- Presentation of information improves by the inclusion of audio and video.
- An MM message is better understood than a textual message.
- Service to customers improves by the use of MSs.
- Video, speech, colour photographs, music, and animations improve the user interface of M&S systems.
H2. Judgements on the value added of retrieval.

- Hyperlinking, search fields, history functions, full text searching, menus and browsers improve the retrieval interface of M&S systems.
- Browsers were not seen significantly to be necessary for promotional CD-i's.

H3. Judgements on the viability of MRSs for M&S.

- Teleshopping/telemarketing systems will be viable after 2-5 or after 5-10 years;
- The viability of MRSs increases with time.
- The increase of the viability of MRSs is supported by market growth indications.


The success/risk factors, for which $H_0$ is rejected and for which respondents agree that they are relevant for MM projects, are:

- complexity;
- scarcity of multidisciplinary expertise;
- too little standardisation of MM products;
- the innovative image of MSs;
- importance of automatic payment functionality;
- importance of MM services provided by competitors.

The success/risk factors, for which $H_0$ is rejected and for which respondents tend to agree (between 'neutral' and agreeing) that they are relevant or important for MM projects, are:

- costs of MM hardware and software;
- costs of telecommunication;
- too little dissemination of the use.

$H_0$ is not rejected for:

- high production costs for audio-visual information;
- costs of using MM information services;
- unstable standards;
- quick dating of products and services.

H5. About system effectiveness.

- An MBC is better than a paper catalogue.
- MM is useful for M&S.
- MM teleshopping is a useful, additional marketing instrument.
- Today, MM teleshop services are expected to improve customer service.
- After about 5 years (1999), surveyed companies will run MM teleshopping services, which are expected to generate new revenues, to attract new customers, and to help in gaining market share.
- Only after about 10 years (2004) it is expected that teleshopping services will meet ROI criteria.
- An MCA can be economic, as shown by the CBA of the IECT photo archive.
- A tele-ordering MBC will be economic for PTT Telecom if only some percent (>1%) of annual revenues is processed by the MBC.

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<tr>
<td>H1-value added of MM</td>
<td>All ( H_0 ) rejected</td>
<td>Test1: most ( H_0 ) rejected after 2-5 years. Test2: most ( H_0 ) rejected after 5 years</td>
<td>All ( H_0 ) rejected</td>
<td>All ( H_0 ) rejected</td>
<td>( H_0 ) rejected after 5 and 10 years</td>
<td>( H_0 ) rejected</td>
<td>( H_0 ) rejected</td>
<td>( H_0 ) rejected for optimistic scenarios</td>
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<td>H2-value added of retrieval</td>
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<td>H3-MRSs are viable</td>
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<td>H4- success/risk factors</td>
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<td>H5-MRSs are effective</td>
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Table 47. Summary table test outcomes.
Chapter 6

Discussion

6.1. Introduction

A framework is presented in the foregoing chapters with which Multimedia Retrieval Systems (MRSs) for Marketing & Sales (M&S) are characterised, and hypotheses on the viability of these systems are formulated and tested. If we now return to the main research question what is the viability of MRSs for M&S, can a satisfactory answer been given to this and related questions?

Is multimedia (MM) only a hype, a self-fulfilling prophecy or has it really value added for MRSs for M&S (section 2.3.), and MM Retrieval (MR) technology (section 6.3.)? Are there MM specific critical success/risk factors for MRSs for M&S, and are these systems effective or perceived as such (section 6.5.), and are they then viable (section 6.6.)?

This chapter is concluded with a discussion of further research issues and speculations on future developments when service economies are transforming into information economies, economies in which more than half of the GNP is produced by information processing activities.

6.2. Towards a new MM paradigm

Has MM value added for MRSs for M&S or is it just hype? On the basis of the consistent responses of experts and other subjects in the field, it can be concluded that MM is perceived consistently to have value added for M&S, for MM Business Catalogues, MM teleshopping and tele-ordering, MM promotion, MM Assisted Instruction, and many other M&S applications. These perceptions are consistent with the MM paradigm that adding MM to ISs leads to an improved information and knowledge transfer to people, and hypothesis (H1) naturally following the multimedia paradigm, stating that MM has value added for M&S in situations where effective information and knowledge transfer is needed.

On the basis of these perceptions alone we can conclude that the idea that an MM paradigm exists is supported, however, we cannot conclude with certainty that MM really has value added. In fact, we can easily falsify the MM paradigm, the MM paradigm is too optimistic:
if MM is used wrongly, incongruently etc., it certainly has a negative value added, it certainly does not lead to improved information and knowledge transfer! Thus, a paradigm shift is needed since the current MM paradigm is in many cases clearly invalid. In what direction should we look for a new MM paradigm?

If we just look at the positive, general attitude with respect to MM, we can interpret this positive attitude towards MM in four alternative ways, leading to four alternative paradigms:

1. MM is statistically significantly believed to have a considerable value added for M&S, but this is definitely not true, MM has hardly any effect at all, *it is only a hype*;

2. MM is statistically significantly believed to have a considerable value added for M&S, but this value added, insofar present, is based solely on the positive attitude with regard to MM, *it is a self-fulfilling prophecy*;

3. MM is statistically significantly believed to have a considerable value added for M&S, but this is only partially true: it is more than just a self-fulfilling prophecy, *it has entertainment value*, but nothing more;

4. MM is statistically significantly believed to have a considerable value added for M&S, and this is true, because it can, if well applied, account also for an improved information and knowledge transfer to people in M&S situations.

Let us look closer at these four alternative interpretations. If we follow the first interpretation sooner or later the MM hype will pass, as the results of MM projects fail completely to meet the high expectations. If we follow the second interpretation, the minimum value added of MM is based on the paradigmatic belief that it is effective, which hence fosters system acceptance, and is therefore a critical success factor for systems, and has as a consequence a positive influence on system viability. If a paradigm shift occurs, sooner or later, the basis for adding MM disappears. If we follow the third and fourth interpretations, MM is no hype at all, it offers real measurable benefits in M&S situations; the value added of MM, if MM is well applied, is based on significant improvements in information and knowledge transfer to M&S people, suppliers and customers and/or on its entertainment value which make MM products and services more attractive for selected user groups.

Can we falsify some of these four statements on the basis of data gathered? The first statements, that MM has definitely no real value added and that it is only a self-fulfilling prophecy, can be falsified on the basis of:

- consistent research (see chapter 4) indicating that people experience MM as fun, as enjoyable, and that MM makes it more exciting to learn;
- the observation that MM games with audio and video are experienced as more attractive to players, than non-MM games.
This brings us to statement three, which is more hard too falsify beyond any doubt, although some results point in the direction of statement four:

- learning experiments made clear that adding MM elements - if the information types are used congruently, an adequate use is made of reference models, a high level of interactivity is offered, and a sufficient quality is used for information representation - improves information and knowledge transfer to people in some learning situations, but not always(!);
- MM information, presented congruently, is better recalled than monomedia information;
- tasks with an object recognition component are performed better when adequate visual representations are used instead of only descriptions or vague pictures.

Alas, there is as yet little comparative, true experimental, evidence that improved information and knowledge transfer also occurs in M&S situations.

Further, indirect evidence for the value added of MM is based on the fact that MRSs for M&S are evaluated as effective in terms of meeting business objectives (see section 6.5.).

On the basis of this argumentation, it can be concluded that MM is not just a hype, it has all the elements of a self-fulfilling prophecy, which does not imply that it is ineffective, it has a distinct entertainment value, and, if carefully applied, sometimes seems to contribute to more effective information and knowledge transfer, which is valuable for many M&S situations. This can form the basis of a more realistic new MM paradigm.

6.3. Has MR value added?

The question if MR has value added (see H2) seems at first sight less controversial than the similar question with regard to the value added of MM; however, the degree to which improved searching and improved database management contributes to improved M&S office work depends on many variables other than the quality of retrieval systems presented. If business objectives can be met by MRSs for M&S, unrelated to improving retrieval and improving database management, the minimum value added of MR technology is still that it is a necessary, facilitating technology to realise retrieval of MM information from local or remote data sources. Just using MR technology is certainly not sufficient for realising a certain business value added!

Let us review the evidence pointing in the direction that MR improves retrieval performance:

- retrieval contributes to a tremendous improvement in search and database management performance, as is observed in all situations where very large collections of information need to be searched, in particular libraries and archives (e.g., the MCA and MDA);
The Viability of Multimedia Retrieval Systems for Marketing and Sales

- retrieval by pictures is reported to enhance photo selection when searching photographs in the IECT photo archive (see chapter 3), the effectiveness is illustrated by "what you see is what you retrieve";
- retrieval facilities including hyperlinking, search fields, history functions for backtracking, full text searching, menus and browsers were perceived by an M&S panel to improve the retrieval interface of M&S systems, both for user interfaces used by customers and M&S personnel; only browsers were not seen significantly as necessary for promotional use.

On the basis of this argumentation, it can be concluded that the minimum value added of MR is that it is a facilitating technology; the maximum value added is that it improves search efficiency and effectiveness and database management performance, these gains can be very significant in cases when archives need to be searched, for example, the MCA and MDA.

6.4. Are there MM specific critical success/risk factors for MRS for M&S?

I hypothesised that there is a number of success/risk factors critical to the viability of MRSs for M&S (H4). The idea that there are no critical success/factors can be falsified on the basis of the fact that system development projects do fail because of factors like lack of management commitment, too high developments costs, no acceptable Return On Investment etc. In the sphere of MRSs for M&S, I observed some failures due to, for example, to poor project preparation and poor definition of business objectives of an MM kiosk. By the way, one can often notice MM kiosks in shops which are completely neglected by the public, whilst others are used more frequently. Case research (see chapter 3), and a survey of MM projects (see chapter 4) made clear that many of success/risk factors are perceived to be critical, and that most of these are also relevant to projects outside the scope of this research.

The relevance of certain MM specific success/risk factors was tested by quantitative surveys (see chapter 5) of MM projects and MM teleshopping investors. The results of these confirmed the idea that there are a number of success/risk factors strongly seen as MM specific, these are: complexity of MM systems due to the integration of multiple types of media, scarcity of MM expertise at the offset of the MM boom, too little standardisation of MM products, the innovative image of MM, and competitive advantage: whether competitors are providing MM services to their customers. It can be argued that these, and probably some other not yet identified, MM specific success/risk factors can be highly critical for the viability of MRSs for M&S.

A longitudinal study is necessary to obtain a better idea of the weight and significance of the presence or absence of certain success/risk factors for system viability, this would be of great interest.

Nevertheless, the lists of success/risk factors and MM specific factors are already useful as a checklist to identify potential threats for system viability.
To conclude, it seems reasonable to assume that there is a large number of success/risk factors, like availability of multidisciplinary expertise, insight into target group and ease of use, that can be critical for the viability of MRSs for M&S, and that some of these are MM specific, but presumably only to a limited degree.

6.5. Are MRSs for M&S effective?

There are strong positive indications that specific MRSs for M&S are effective in meeting M&S business objectives, most of these systems are, at least, perceived as effective by the majority of respondents: researchers, project leaders, M&S staff, and service providers (hypothesis H5). The qualitative analysis, in chapter 3, of cases made clear that several MRSs for M&S, such as a Marketing Communications Archive, Tele Sales Assistant system, Multimedia Promotion System, and Multimedia Assisted Instruction system are strongly perceived as effective in meeting their respective M&S business objectives. These objectives for MRSs are related to improving or better defending a market position, improving the quality of service to customers, improving promotion effectiveness, saving M&S costs or improving the M&S productivity, improved information and knowledge transfer, and improved management insight in archiving costs.

Expert surveys, in chapter 5, showed that an MBC and an MPS in the form of a promotional CD-i, are perceived as effective. But are MRSs effective? On the basis of a Cost Benefit Analysis (CBA) and Return On Investment (ROI) computation we can reject the hypothesis that MRSs are never effective: the IECT photo archive (an MCA) showed a ROI of 900% (!), a tele-ordering MBC was effective in 5 out of 6 of the sketched situations, and one MAI described in the literature showed has also been shown to be economic (Kustermans, 1991; see chapter 3).

A qualitative analysis showed that the Virtual Market is the most ambitious and potentially the most effective MRS for M&S, as it offers an integrated platform for many VM services for many market parties and is able to meet all possible M&S business objectives to a relatively large degree. At the same time, the VM is the most risky investment, as it requires large investment in information infrastructures as yet not present. A survey of current and potential teleshop service providers, whose services can run eventually in a VM, showed that it is believed it would be economically effective, i.e., meet ROI requirements, in about 10 years from now. Thus, a full fledged VM, depending on the information services it provides, will probably be only effective after about the same time.

It is very alarming that in most projects surveyed no serious effort was made to quantitatively evaluate the effectiveness of MRS for M&S. Some of the explanations for this is that it is very difficult to perform a reasonable effectiveness evaluation, that it is relatively too expensive for small projects, and that relatively little IT evaluation expertise is present within R&D environments, software development firms, and M&S environments. Although CBAs and ROI computations have their limitations, such IT evaluation methods are useful to identify the real benefits for systems under development. Even if benefits are hard to quantify, hardly reliable and have little validity, such measures are better than nothing!
Most researched MRSs for M&S are perceived as effective, but only in a very few cases is an IT evaluation attempt made. CBA, as part of this research, showed that an MCA and an MBC for tele-ordering can be economically effective. The potential effectiveness of tele-ordering systems is great.

6.6. What is the viability of MRSs for M&S?

Let us now return to my main research question, what is the viability of MRSs for M&S, to see if a satisfactory answer can be given to this question on the basis of the results of this research.

There are some strong indications that MRSs for M&S are viable, and that this viability increases with time:

- During my research I hit upon a large number of cases, a number of which are described in chapter 3, of MRSs that were able to survive under business conditions, that were actually in use, sometimes for longer, sometimes for shorter times. Thus, MRSs have a certain level of viability today, which varies from case to case from 0% to 100%.
- MM teleshop services are perceived as viable by Videotex information providers, and other suppliers, in the middle term (in about 5 years from 1994) or at least in the long term (in about 10 years from 1994); these perceptions are very consistent, and can be interpreted as a predictor of future viability. The validity of this predictor is uncertain of course, although the convergent validity, the correlation of outcomes with market forecasts, is high.
- MM experts see MM teleshopping and MM telemarketing as increasingly important for the business of a telecommunication company; after about 5 years (about 1999) it was estimated 'important'; however, on a retest the judgement was only 'neutral' (see chapter 5).
- There are positive indications from market research about the growth of retrieval technology, MM, Points Of Sale, interactive TV, etc.
- MRSs are perceived as effective and some are clearly economically effective (see section 6.5.) and this is a positive indication of system viability;
- MM has a certain value added which can contribute to the viability of ISs, because MM is perceived to be effective and increases the entertainment value and probably the information impact of ISs (see section 2.3.)!

Despite these positive indications, the viability of specific MRSs for M&S can never be guaranteed, and many failures can be observed, for example in the form of ignored Points Of Information in shops; if certain success/risk factors are neglected or if MM technology is not well applied, the results can be very disappointing indeed!

To conclude, there are strong indications that the viability of MRSs for M&S in general, increases with time; specific examples can be found of MRSs for M&S that are able to survive business conditions now, but Virtual Market related MRSs such as MM teleshopping and MM tele-ordering systems are not viable today, but are estimated to be viable within 5-10 years. Specific MRSs for M&S are only viable if identified success/risk
factors are coped with, the value added of MM and MR is well understood, and significant business objectives are met!

6.7. Further research issues

The research approach followed to tackle the viability of MRSs for M&S problem led to insight into the research domain, and many suggestions for improvements of specific MRSs (see chapter 3). At the current point, insight into system effectiveness and system viability of specific MRSs can be improved by:

- surveying consumer responses, already decided on in the context of market pilots of MRSs related to the VM concept;
- approximating true experimental conditions in in vivo business settings, and not only with regard to learning effectiveness; in case of the TSA system a Two Group Pretest Post-test Design was conceived, but uncontrollable variables like the effects of a huge marketing campaign to stimulate telephone ordering could not be 'eliminated' by the design;
- improving the reliability of some underperforming tests (CD-i, MBC) by increasing the sample and/or increasing the number of items measuring the same variable;
- longitudinal research to observe the real viability of the Virtual Market, to answer some of the questions still unanswered: what is the predictive validity of our predictors of system effectiveness and viability?
- using success/risk factors to confront very large samples (n > 1000) with statements about the relevance of these factors; the most important ones can be used to put together some kind of a 'stress test' for MR projects, a 'viability threat scale';
- extending the framework with identified business objectives, critical success factors, and IT evaluation elements to identify significant business opportunities and to measure critical viability threats.

6.8. Some speculations about surviving information competition

What are the implications of the findings? One significant implication of this research is that the MM paradigm should be firmly rejected in favour of a more realistic approach with regard to the business value added of MM and MR, and the effectiveness and viability of MRSs for M&S.

Further, we can speculate that MM service providers and information providers that want to survive service competition, and growing information competition in the next century,

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43Information competition means that quality of information has become the main competitive edge for companies. The idea of information competition is based on the growing share of information industries in the world economy; in the year 2000 about 15% of the GNPs of western countries will be generated by information industry as is estimated by the New Brunswick Task Force on the Electronic Information Highway (1994). Whether this estimate is too optimistic or not, when will we have a real information economy, in
will have to prepare themselves for the VM, which may make use of the fast growing and commercialising Internet infrastructure.

If we assume that viability indications are good predictors of the future viability of MRSs for M&S, it can be argued that a full-grown VM market offering all kinds of MR services to customers, will be really viable in the first decades of the 21st Century.

MM service and information providers need to prepare themselves today, to be ready for an awakening market within 5 years, and a profitable market after about 10 years! Preparation means:

- being able to provide specific MM services to customers and suppliers;
- being able to set up and support VM services;
- preparing the organisation and information infrastructure for direct telesales and direct telemarketing;
- being able to produce, archive and retrieve MM M&S information to support all M&S processes;
- support of MM transactions and order processing, integrated logistics in service chains.

In other words: **cannibalise the vulnerable parts of your retail channel and other conventional sales outlets before your competitor does!**

If you do not invest today, you may run the risk of being left out of the game. The same is true for information providers in relation to the VM, if they are not prepared, they run the risk of loosing service competition and, particularly relevant for information industry, information competition. Although success, when setting up MM teleshop services, is not guaranteed, potential efficiency and effectiveness gains surpass by far the costs. The first M&S organisations able to create a win-win situation with their customers, can gain tremendously. If in the coming ten years M&S organisations invest massively in MM teleshop and tele-order services, the outlets of these organisations will go through a radical change! Bulk products and commodities will be far less often sold by intermediate retail organisations and M&S personnel, and particularly in the business to business market, the growth in the use of MM tele-order services, enforced by offering discounts to tele-ordering customers, may affect significantly the size of sales staff. In the high quality/high prices market segment, however, personal sales and personal care will prevail, although one can notice that some expensive, high quality products are sold via television advertisement and telephone ordering!

In the consumer market, it is hypothesised that working people, with little spare time, are more prone to purchasing commodities using MM teleshop services than others, yet, we **should not underestimate the need of people to browse physically through shopping streets, to touch and smell products using their senses, and to enjoy strolling around in the three-dimensional, REAL world!**

which information industries account for more than 50% of the GNPs? In 2030? In 2050? In 2070?

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# Appendix A

## Abbreviations

<table>
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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>ADSL</td>
<td>Asymmetric Digital Subscriber Line</td>
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<tr>
<td>API</td>
<td>Application Programming Interface</td>
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<td>ATM</td>
<td>Asynchronous Transfer Mode</td>
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<td>B-ISDN</td>
<td>Broadband-ISDN</td>
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<td>BLOB</td>
<td>Binary Large OBject</td>
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<td>BU</td>
<td>Business Unit</td>
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<tr>
<td>CAD/CAM</td>
<td>Computer Aided Design/Computer Aided Manufacturing</td>
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<tr>
<td>CAI</td>
<td>Computer Assisted Instruction</td>
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<tr>
<td>CATV</td>
<td>CAble TV (network)</td>
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<td>CBA</td>
<td>Cost Benefit Analysis</td>
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<td>CCITT</td>
<td>Comité Consultatif International Téléphonique et Télégraphique</td>
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<td>CD</td>
<td>Compact Disk</td>
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<td>CD-DA</td>
<td>CD-Digital Audio</td>
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<td>CD-E</td>
<td>CD-Erasable</td>
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<td>CD-i</td>
<td>CD-interactive</td>
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<td>CD-MO</td>
<td>CD-Magneto-Optic</td>
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<td>CD-R</td>
<td>CD-Recordable</td>
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<td>CD-ROM</td>
<td>CD-Read Only Memory</td>
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<tr>
<td>CD-ROM/XA</td>
<td>CD-ROM/eXtended Architecture</td>
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<td>CD-V</td>
<td>CD-Video</td>
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<tr>
<td>CSCW</td>
<td>Computer Supported Co-operative Work</td>
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<td>DAT</td>
<td>Digital Audio Tape</td>
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<td>DBA</td>
<td>Data Base Administrator</td>
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<td>DBMS</td>
<td>Data Base Management System</td>
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<td>DM</td>
<td>Direct Marketing</td>
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<td>DCC</td>
<td>Digital Compact Cassette</td>
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<td>DDL</td>
<td>Data Definition Language</td>
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<td>DMF</td>
<td>Data Modelling Facility</td>
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<tr>
<td>DML</td>
<td>Data Manipulation Language</td>
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The Viability of Multimedia Retrieval Systems for Marketing and Sales

DTP  Desk-Top Publishing
FDDI  Fibre Distributed Digital Interface
FIF  Fractal Interchange Format
GB  Gigabyte
GIS  Geographic Information System
GNP  Gross National Product
GUI  Graphical User Interface
HD  Hypermedia Document
HDSL  High-bitrate Digital Subscriber Line
HS  Hypermedia System
ICR  Intelligent Character Recognition
IP  Information Provider
IRS  Information storage and Retrieval System
IS  Information System
ISDN  Integrated Service Digital Network
ISO  International Organisation for Standardisation
ISPE  Information Service Production Environment
IT  Information Technology
JBIG  Joint Bi-level Image expert Group
JPEG  Joint Photographers Expert Group
LAN  Local Area Network
MAI  Multimedia Assisted Instruction
MB  Megabyte
MBC  Multimedia Business Catalogue
MCA  Marketing Communications Archive
MDA  Marketing Documentation Archive
MDBMS  Multimedia DBMS
MHEG  Multimedia and Hypermedia information coding Expert Group
MM  Multimedia
MPC  Multimedia PC
MPEG  Moving Pictures Expert Group
MPS  Multimedia Promotion System
MR  Multimedia Retrieval
MRS  Multimedia Retrieval System
MS  Multimedia System
MT  Multimedia Technology
M&S  Marketing & Sales
N-ISDN  Narrowband-ISDN, same as ISDN
NP  Network Provider
OCR  Optical Character Recognition
ODA  Open Document Architecture
OO  Object Oriented
OO-DBMS  Object Oriented DBMS
<table>
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<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>PDA</td>
<td>Personal Digital Assistant</td>
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<tr>
<td>PDH</td>
<td>Plesiochronous Digital Hierarchy</td>
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<tr>
<td>PIC</td>
<td>Personal Intelligent Communicator</td>
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<tr>
<td>POI</td>
<td>Point Of Information</td>
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<tr>
<td>POP</td>
<td>Point Of Purchase</td>
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<tr>
<td>POS</td>
<td>Point Of Sale</td>
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<tr>
<td>PSTN</td>
<td>Public Switched Telephone Network</td>
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<tr>
<td>RDBMS</td>
<td>Relational DBMS</td>
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<tr>
<td>RGB</td>
<td>Red Green Blue (projector or screen)</td>
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<tr>
<td>ROI</td>
<td>Return On Investment</td>
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<tr>
<td>RTOS</td>
<td>Real Time Operating System</td>
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<tr>
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<td>Sales Assistant</td>
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<td>WAN</td>
<td>Wide Area Network</td>
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Appendix B

Terminology

Cost Benefit Analysis (CBA): an evaluation technique by which costs and benefits for a specific project are quantified to compute profits.

Data: a representation of facts or ideas in a formalised way, that makes communication with or manipulation by another process possible (Sol, 1992).

Database management: the management of data in a database, including facilities for searching, updating, and presentation of data objects, data modelling, access control, transaction management, and thesaurus management.

Database management system (DBMS): a system that performs database management and offers support to a DBA.

Database system: an integrated whole of one or more retrieval engines and one or more databases.

Direct Marketing: an interactive system of marketing which uses one or more advertising media to effect a measurable response and/or transition at any location (Direct Marketing Association) (Burnett, 1993).

Effectiveness: "are we doing the right things", the degree to which formulated goals are actually met (Wentink & Zanders, 1988).

Grounded theory: a related set of ideas or hypotheses induced by empirical research data, a theory that is closely related to a limited empirical research domain (Glaser & Strauss, 1967).

Hypermedia system: a multimedia system which supports hyperlinking, i.e., non-sequential tracing of links between any two objects in a database.
Interchange medium: the type of means to interchange data; it can be either a storage medium, a transmission medium or a combination (ISO/IEC, 1993).

Information: the meaning which is expressed and communicated using one or more information types.

Information competition: quality of information as a major competitive edge for companies within an information economy.

Information economy: an economy in which more than half of the GNP is produced by information processing activities.

Information storage and Retrieval System (IRS): a retrieval engines specialised in the storage, management and retrieval of ill structured data, e.g. text in text documents.

Information service: a service delivered by one or more information workers, which mainly consists of information transfer. An information service can be seen as an information product.

Information type: same as perception medium; the term information type is preferred.

Marketer: someone seeking a resource from someone else and willing to offer something of value in exchange (Kotler, 1991).

Marketing: the process of planning and executing the conception, pricing, promotion, and distribution of ideas, goods and services to create exchanges that satisfy individual and organisational objectives (American Marketing Association) (Kotler, 1991).

Marketing and Sales: those business processes in an organisation which are directly related to the marketing and selling of goods and services, including support processes such as training sales staff and performing marketing research.

Marketing Communications Archive (MCA): a centralised on-line archive for all marketing communications that are regularly reused by marketing organisations for advertisement, promotion and PR.

Medium: a means to transfer and distribute information.

Multimedia: the property of a system or object indicating that multiple information types or perception media, such as speech, music, text, graphic, still, animation and video are used in an integrated manner.
Multimedia Aided Instruction (MAI) system: multimedia courseware, supporting an individual or group learning process relatively independently of teaching location and teaching time, in which interactive elements and media richness are used to improve the learning effect.

Multimedia data: data that is represented using multiple representation media (related to multiple information types).

Multimedia Business Catalogue (MBC): a multimedia system which presents the complete business assortment vividly, and offers transparent support of all assortment related processes to business sales staff and large business accounts.

Multimedia DBMS: a DBMS providing facilities for the management of multimedia databases.

Marketing Documentation Archive (MDA): an on-line central archive for the storage and retrieval of valuable marketing documentation, that support document centred back office marketing processes.

Multimedia information: information which is expressed using multiple information types, like coded text, graphics, audio, still pictures and audio-visual sequences.

Multimedia paradigm: the dominant conviction that adding multimedia functionality to information systems (ISs) leads to improved information and knowledge transfer to people.

Multimedia Promotion System (MPS): an interactive audio-visual marketing system that introduces services to individual visitors or audiences to motivate them to purchase these services.

Multimedia Retrieval System (MRS): a multimedia system with a clear retrieval component, true MRSs are able to access and manage multimedia databases, and to store, retrieve and present multimedia information.

Multimedia Retrieval System (MRS) for Marketing & Sales (M&S): a multimedia system with a clear retrieval component, that supports one, or more, M&S processes.

Multimedia Retrieval technology: the IT enabling the development and tuning of MDBMSs to perform the storage, management and retrieval of multimedia data.

Multimedia System (MS): an information system, used to process or present multimedia information.
Multimedia technology: the information technology that enables a synchronised use of multimedia information by Multimedia Systems.

Perception medium: the nature of the information as perceived by the user, e.g., speech, noise, music, text, graphic, video (ISO/IEC, 1993). Within the multimedia literature just the word 'medium' is used, but this somewhat ambiguous word is avoided here.

Presentation medium: the type of the physical means which is used to reproduce information to the user, i.e., output device, or to acquire information from the user, i.e., input device. E.g., computer screen, printer, loudspeaker, keyboard, mouse, microphone, camera, etc. are presentation media (ISO/IEC, 1993).

Primary data: data that have been specially prepared for the specific problem at hand, thus in contrast to existing secondary data.

Primary information item: an information item that is part of the output of the primary process of a firm, e.g., an information product like a telephone book on CD-ROM.

Product assortment: the choice of products offered within a line of merchandise carried.

Product variety: the number of lines of merchandise carried.

Productivity: a measure of how much output is produced per production; often the ratio output/input is used (Wentink & Zanders, 1988).

Qualitative media effect: what the medium does to enhance or depreciate a message after the medium has delivered the message (Burnett, 1992).

Quality of service: the degree to which customers appreciate services provided.

Representation medium: the type of the interchanged data, which defines the nature of the information described by its coded form, e.g., telex, ASCII, EBCDIC for text; CEPT, NAPLPS for graphics; CCITT G711, MIDI, MPEG/audio for audio; JPEG en Fax Group 3 for stills; etc. (ISO/IEC, 1993).

Return On Investment (ROI): an effectiveness measurement, the ratio between profits and investment.

Retrieval paradigm: the dominant conviction that all tasks or processes which include search and database management (sub)tasks will benefit from electronic retrieval systems.

Secondary data: existing data, not having been prepared for the specific problem at hand, thus in contrast to primary data.
**Secondary information item**: an information item that, directly or indirectly, supports one or more primary processes of a firm; for example information items forming a part of marketing actions, e.g., an advertisement in a newspaper for a mobile phone, customer care information items, e.g., a consumer catalogue, and M&S support information items, e.g., a manual for a telephone switch; these information items are by nature in many cases multimedial.

**Service competition**: quality of services provided is the major competitive edge for companies within a service economy (Grönroos, 1990).

**Service economy**: an economy in which more than half of the GNP is produced by the service sector.

**Storage medium**: the type of physical means to store data, e.g., hard disk, floppy disk, CD, etc. (ISO/IEC, 1993).

**Structured data**: data which is structured into tables and the meaning of which meaning depends on data definitions.

**Success/risk factor**: a factor that is critical to the success of a project or system.

**Tele Sales Assistant (TSA) system**: a front office sales assistance system which offers support for order intake and complaint handling, that is integrated seamlessly with back office order handling and product management processes.

**Transmission medium**: the type of physical means to transmit data, e.g., coax cable, telephone cable, etc. (ISO/IEC, 1993).

**Viability**: the state of being able to survive under business conditions. The viability of a system can be operationalised as a combination of frequency, intensity and duration of system use or as market acceptance, technical feasibility and expert perception of viability.

**Virtual market (VM)**: a global and public electronic market place, that has a transparent user interface, where demand can meet supply freely.
Appendix C

Questionnaires and results

C.1. Expert Assessment MM Cluster

C.1.1. Questionnaire

Introduction
To assess the importance that multimedia experts attach to multimedia application areas for the business of PTT Telecom, we ask you to answer the questions given below. These questions are always related to the PTT Telecom interest in the short term (0-2 years), in the middle term (2-5 years), and in the long term (>5 years). Give an answer by putting a cross on the scale, running from 1 (very unimportant) to 5 (very important). You may put a cross between the numbers. Don't think too long about the questions, answer them quickly.

1. *How important is the multimedia cluster AVT (Audio Visual Telecommunication) for the business of PTT Telecom?*

   0-2 years:
   - Very unimportant: 1
   - 2-5 years:
   - Very unimportant: 1
   - >5 years:
   - Very unimportant: 1

2. *How important is the multimedia cluster Teleshopping/telemarketing for the business of PTT Telecom?*

   0-2 years:
   - Very unimportant: 1
   - 2-5 years:
   - Very unimportant: 1
   - >5 years:
   - Very unimportant: 1
3. How important is the multimedia cluster Infotainment for the business of PTT Telecom?
   
   0-2 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important
   2-5 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important
   >5 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important

4. How important is the multimedia cluster Security for the business of PTT Telecom?

   0-2 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important
   2-5 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important
   >5 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important

5. How important is the multimedia cluster MM Store & Forward Services for the business of PTT Telecom?

   0-2 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important
   2-5 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important
   >5 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important

6. How important is the multimedia cluster Electronic Publishing and Information Retrieval for the business of PTT Telecom?

   0-2 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important
   2-5 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important
   >5 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important

7. How important is the multimedia cluster Office and Process Automation for the business of PTT Telecom?

   0-2 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important
   2-5 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important
   >5 years:
   
   Very unimportant 1---------2---------3--------4--------5 Very important
### C.1.2. Results

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C.2. MM Projects survey

C.2.1. Questionnaire

Introduction
We describe and analyse a number of multimedia projects with a telecommunication component to get insight into the characteristics, opportunities and risks of applying multimedia technology. We therefore decided to carry out a number of interviews on the basis of a questionnaire.
We would like to interview you because your multimedia project is interesting for our research. We will handle your information confidential.
The questionnaire has the following structure. First, some general questions will be asked. Next, we want to pursue the motivation of the project participants. Afterwards, we will go deeper into the functional and technical characteristics of your multimedia system, including the system development process. Finally, we ask some evaluative questions.
The interview will take about 1 hour.

1. General
1.1 What is the name of the project?
1.2 Who is the respondent? What project documentation or literature is available?
1.3. What is the status of the project?
   O In preparation   O Halted
   O Current         O Finished
1.4. What is the phasing of the project?
1.5. Who are the project participants, and what are their roles?

2. Motivation
2.1. What are the business objectives of the project, for every participant?
   O Exploring business opportunities, viz.
   O Improving or developing a service, viz.
   O Improving or setting up business processes, viz.
   O Improving or developing a product, viz.
   O Otherwise, viz.
2.2. What is (are) the marketing objective(s) of the project, per participant?
   O Irrelevant
   O Exploring of market potential
   O Entering a new market
   O Extending a market position
   O Defending a market position
2.3. What is the value added of multimedia in this project?
   O More information, viz.
   O Usability, viz.
   O Indispensable for a process, viz.
   O Improved presentation, viz.
   O Understandability of information, viz.
   O Flexible input and output, viz.
   O Fun, viz.
   O Otherwise, viz.
2.4. What are approximately the costs of the project, per participant?
2.5. What are the expected benefits of the project in the coming years?
   a) Will there be Return On Investment?  O Yes  O No  O No idea
   b) In how many years?
   c) What are the benefits?

2.6. If the project results in a commercial product or service:
   a) What are the market expectations?
   b) Is it a semimanufacture or a finished product or service?
   c) What are the distribution channels, if any?
   d) What are the targeted market segments?
   e) What is the pricing of the product or service?

3. Functional characteristics of the multimedia system

3.1. What functionality is provided by the system?

   Please draw the functional components in a scheme.

3.2. The multimedia project results in an application in the category(ies):

   O Public Relations
   O Sales Support
   O Electronic Publishing
   O Geographic Information Management
   O Education and training

   O Office work
   O Otherwise, viz.

3.3. It is in application in the sector(s):

   O Agriculture/fishing
   O Industry
   O Building industry and contractors
   O Transport, storage, communication

   O Private services
   O Automation

3.4. What keywords are typical for the multimedia system?

   O Kiosk
   O Medical Imaging System
   O CAD/CAM System
   O Electronic Publishing System
   O Electronic Mail System
   O Presentation System
   O Monitoring and Security System
   O Simulator
   O Animation

   O Marketing
   O Entertainment
   O Medical Imaging
   O Library and Archive Management
   O Exhibitioning (museums and galleries)
   O Meeting Support

   O Mining
   O Public utilities
   O Trade, catering, repair
   O Banking and insurance, exploitation of real estate
   O Government
   O Other non-profit services

   O Catalogue
   O Document Retrieval System
   O Geographic Information System
   O Desktop Videoconferencing System
   O Courseware
   O Computer game

   O Value Added Network System
   O Demonstrator
O Computer Supported Co-operative Work System
O Hypermedia System
O Communication System
O Virtual Reality System
O Otherwise, viz.

3.5. Who are the users of the system?

PROFESSIONAL
O Managers
O Documentalists
O Teachers/trainers
O Production employees
O Marketers
O Researchers
O Secretariat employees
O Business customers
O Editors/designers
O Audio/video engineers
O Medical specialists
O Students/trainees

NON PROFESSIONAL
O Customers at a counter
O Otherwise, viz.
O Consumers

a) How many users per category?
b) Spread over how many locations?
c) What level of computer literacy is expected of users?
d) In what ways are the users involved in the project?

3.6. What is the nature of the use in relation to the information life cycle?

O Production of MM information
1. Gathering
2. Pre-processing
3. Editing
4. Authoring/programming
O Communication of MM information
1. Volatile communication, e.g., interpersonal
2. Non-volatile communication, e.g., document exchange
O Consumption of MM information
1. Retrieval
2. Delivery
3. Presentation
O Management of MM information
1. Update (Delete, Change, Add)
2. Access Control
3. Integrity Control
4. Archiving
5. Administration of use
6. Otherwise, viz.

3.7. What kinds of information are used? (e.g., product catalogue, news bulletin, patient file)

3.8. The multimedia system supports the following information types (perception media):

VISUAL
O Table (data)
O Graphics
O Video
O Visual effects
O Text
O Still (photograph)
O Animation

AUDITIVE
O Music
O Sound effects
O Speech
TACTILE
- Pressure
- Process data

OTHER DATA
- Otherwise, viz.

3.9. What level and types of interactivity is supported?
- Only presentation
- Query and answer
- Editing and creation of new information objects
- Interpersonal communication

4. Technical characteristics of the multimedia system

4.1. What technologies are used?

4.2. What presentation media are used?

INPUT MEDIA
- Keyboard
- Joystick
- Microphone
- Video camera
- Otherwise, viz.

OUTPUT MEDIA
- TV display
- Computer display
- Otherwise, viz.

4.3. What storage media (or distribution media) are used?
- Hard disk
- CD-i
- DAT/DCC tape
- Otherwise, viz.

4.4. What transmission media are used?
- Private network
- Satellite connection
- Cable-TV
- Otherwise, viz.

What transmission requirements are put forward?

4.5. What is the contribution of the project telecommunication infrastructures?

4.6. What standards are supported or developed? (e.g. JPEG, MPEG1, SGML, ODA)

5. System development

5.1. How is your management involved in the project?

5.2. Can you describe the project organisation?

5.3. What organisational changes are expected/planned?

5.4. What methods and techniques for system development are used?

5.5. What are the highlights and bottlenecks in the following phases?
a) Preparation  
c) Building  
c) Use and Maintenance  
b) Design  
d) Implementation  

6. Project analysis  
6.1. To what degree are the project objectives met?  
6.2. What organisational changes are implemented? Which not?  
6.3. What are the test results?  
6.4. How was the co-operation between the project participants?  
6.5. What are the success factors and failure factors of the project? Why?  
6.6. What are the success factors and failure factors of the system? Why?  

C.2.2. Resulting lists of success/risk factors and business objectives  
The project management success/risk factors are grouped below.  

- **Availability of multidisciplinary expertise**  
  - Availability of MM expertise  
  - Selection of retrieval mechanisms  
  - Insight into usability and ergonomical aspects  
  - User involvement  
  - A too technical orientation  

- **Insight into target group**  
  - Insight into the services that users in the target group want to use  
  - Analysis of the target group  
  - Focus on (vertical) market, market segmentation.  

- **Organisational change**  
  - Being able to mobilise the organisation.  
  - Setting up maintenance procedures.  
  - Fundamental changes in M&S process.  
  - Enthusiasm.  
  - Resistance to change.  

- **Preparation**  
  - The lack of a serious preliminary study  
  - Poor definition of clear business objectives  
  - Poor system definition  
  - Poor system specifications  

- **Development and implementation costs**  
  - Budget restrictions  
  - Stringent price control  
  - High costs of MM information production  
  - Copyrights  

- **Time pressure**
The Viability of Multimedia Retrieval Systems for Marketing and Sales

- Long development cycles
- Time control
- **Co-operation with other parties/partners**
  - Dropping out partners
  - International co-operation which helps to
  - Mutual responsibility and commitment
- **Insight into business value added**
  - Too much uncertainties make it impossible to calculate ROI
  - Little insight into the real costs
  - Insight into system effectiveness
  - Proving business value added
  - Striving for too quick ROI
- **System integration problems**
  - Bugs in software and hardware
  - Integration of software and hardware components
  - Inadequate technology
  - Rapidly evolving and unstable technology
- **Marketing of project results**
- **Management commitment**
  - Management consensus
  - Presence of a strategic management vision
- **Training of personnel**
  - Knowledge to translate user requests into system requests
  - Training of involved people
- **Flexible ways of system development**
- **Testing the system**

The system risk/success factors are grouped below.

- **Integration with IT infrastructures**
  - IT history
  - Distribution aspects
  - Lack of standardisation
  - Reaching the world through a network
  - Integrated service
  - Integration of scattered M&S systems
  - Complexity MRS
- **Ease of use**
  - General usability aspects
  - Quality of the user-interface
  - Accessibility
- **Flexible user support**
  - Different types of users with different ways of working
Different types of media offer more functionality
- Sell help aspects
- Improved human information processing
- Quick retrieval

**System and use costs**
- Competitive priced MR products and services
- Costs of developing and using MRSs
- High MM communication costs

**Quality of information**
- Completeness
- Topicality
- Understandability
- Presentation quality
- Communication value
- Reality value

**Motivational system aspects**
- MM is appealing
- Visible value added for users
- Valuable and meaningful content for the target group
- Interactivity

**Image**
- MM is seen as innovative
- Computers are impersonal media

**Placing**

**Technical reliability**
- Quality of network services

The business objectives are grouped below.

**Improving a market position**
- Exploring market opportunities.
- Defending an old market position against old and new competitors
- Extending a market position.
- Entering a new market. Internationalisation of MM services.

**Improving quality of service**
- Quality of customer support by improved catalogues etc.
- Customers will gain more choice, convenience and value.
- Improved customer relations.
- Anonymous use of an MS by customers.
- Offering around the clock shopping services
- Improved entertainment (fun) for customers
- Extending the service area

**Improving promotion**
- Improving corporate image
- Making a (brand) name.
- Improved retention
- Preventing low quality exposure.

**Efficiency gains**
- Saving training costs
- Saving promotion costs
- Efficient multimedia production
- More efficient sales process
- More efficient archive management.

**Improved productivity**
- Time advantages
- Increasing the sales volume

**Improved information and knowledge transfer**
- Improved training effectiveness.
- Improved knowledge level of personnel.
- Improved information provisioning about products and services.
- Stimulating corporate re-use of information

**Increased management insight**
- Insight into costs
- Quality control

### C.3. MM Projects: value added and risk factors

#### C.3.1. Questionnaire

**Introduction**
We describe and analyse a number of multimedia projects with a telecommunication component to get a clear view on the characteristics, opportunities and risks of applying multimedia technology. We therefore decided to carry out a number of interviews on the basis of a questionnaire. We would like to interview you because your multimedia project is interesting for our research. We will handle your information confidential.

You will be confronted with a number of statements. Please, answer them quickly without thinking for too long a time.

1. **Statements about the Value Added of MM**
   1.1. The user friendliness of an information system improves with MM
       Strongly disagree 1---------2---------3---------4---------5 Strongly agree
   1.2. The presentation of information improves with the use of audio and video
       Strongly disagree 1---------2---------3---------4---------5 Strongly agree
   1.3. A MM message is understood better than a textual message
### Appendix C. Questionnaires and results

1.4. The service to customers improves with use of MM systems

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>1---2---3---4---5</th>
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2. The following risk factors are typical for multimedia projects

2.1. Complexity

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2.2. Scarcity of multidisciplinary expertise

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2.3. High production costs for audio-visual information

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2.4. Too little standardisation of multimedia products

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3. The following factors are risk factors for the introduction of multimedia products and services

3.1. High costs of hardware and software

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3.2. High costs of using information services

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3.3. High costs of telecommunication

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3.4. Too little dissemination of use

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3.5. Unstable standards

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3.6. Fast outdating of products and services

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### C.3.2. Results

\( \bar{X}_{\text{odd}} \) and \( \bar{X}_{\text{even}} \) were used for the computation of the split-half correlation coefficient and the Spearman-Brown coefficient. \( \bar{X}_{n1-n9} \) is the average of non-PTT Research respondents and \( \bar{X}_{n10-n20} \) is the average of the 11 PTT Research-respondents. The last three columns in the table below (df, t, p) give the results of a two-tailed t-test assuming unequal variance to test the hypothesis that the means of PTT Research respondents and non-PTT Research respondents are equal.

---

229
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C.4.1. Questionnaire

Name:
Function:
(Business) Unit:

Introduction
To evaluate the value added of multimedia and retrieval functionality for the AS, General Specification pages, catalogue we would like to ask you a number of questions. It is not our objective to evaluate the presented demonstrator, but to find out what the demonstrated options may contribute to an electronic catalogue and sales support.

The questions are subdivided into the categories multimedia and retrieval. A scale is presented for every question ranging from 1 to 5, with the middle value (3) meaning 'neutral'. You can make your choice by encircling a number. Please, do not think too long before answering. You have also the possibility to explain your answer for every question.

Multimedia
1. Do you think that a similar multimedia catalogue is better or worse than a paper catalogue for sales support?
   Much worse  1--------2---------3---------4---------5  Much better
   Why?
2. How do you judge the addition of video to the catalogue?
   Very negative  1--------2---------3---------4---------5  Very positive
   Why?
3. How do you judge the addition of speech to the catalogue?
   Very negative  1--------2---------3---------4---------5  Very positive
   Why?
4. How do you judge the addition of colour pictures to the catalogue?
   Very negative  1--------2---------3---------4---------5  Very positive
   Why?
5. Do you miss any multimedia aspects? Why?

Retrieval
1. How do you judge the support of hyperlinks, by tracing underlined references to related information?
   Very negative  1--------2---------3---------4---------5  Very positive
   Why?
2. How do you judge the support of searching by entering key words in search fields?
   Very negative  1--------2---------3---------4---------5  Very positive
   Why?
3. How do you judge the possibility to have a History overview to return to previous consulted information?  
   Very negative 1--------2--------3--------4--------5 Very positive
   Why?

4. How do you judge the possibility for full text searching?  
   Very negative 1--------2--------3--------4--------5 Very positive
   Why?

5. How do you judge the possibility to find information via a menu structure?  
   Very negative 1--------2--------3--------4--------5 Very positive
   Why?

6. How do you judge the possibility to search by browsing a list of product names, which you can restrict by searches?  
   Very negative 1--------2--------3--------4--------5 Very positive
   Why?

7. Do you think it is necessary to compile tailor made catalogues?  
   yes/no

8. Do you miss any retrieval facilities? Why?

Do you have any additional remarks about the demonstrator?

THANK YOU FOR FILLING IN THE EVALUATION FORM!

C.4.2. Results

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C.5. Promotional CD-i

C.5.1. Questionnaire

Name:
Function:
(Business) Unit:

Introduction
To evaluate the value added of multimedia and retrieval functionality of the CD-i for sales support we would like to ask you a number of questions. It is not our objective to evaluate the presented demonstrator, but to find out what the demonstrated options may contribute to sales support. The questions are subdivided into the categories marketing & sales, multimedia and retrieval. A scale is presented for every question ranging from 1 to 5, with the middle value (3) meaning 'neutral'. You can make your choice by encircling a number. Please, do not think too long before answering. You have also the possibility to explain your answer for every question.

Marketing & Sales
1. *Do you think that the CD-i is a useful medium for marketing & sales?*  
   yes/no
   Why?
2. *What sort of marketing & sales opportunities do you see for the CD-i?*
   a.
   b.
   c.

Multimedia
1. *How do you judge the addition of video to product presentations for customers?*
   Very negative 1-------------2-------------3-------------4-------------5  Very positive
   Why?
2. *How do you judge the addition of speech to product presentations for customers?*
   Very negative 1-------------2-------------3-------------4-------------5  Very positive
   Why?
3. *How do you judge the addition of music to product presentations for customers?*
   Very negative 1-------------2-------------3-------------4-------------5  Very positive
   Why?
4. *How do you judge the addition of colour pictures to product presentations for customers?*
   Very negative 1-------------2-------------3-------------4-------------5  Very positive
   Why?
5. *Do you miss any multimedia aspects? Why?*
The Viability of Multimedia Retrieval Systems for Marketing and Sales

Retrieval
1. How do you judge the possibility that customers can make use of hyperlinks, via buttons to jump to related information?
   - Very negative: 1
   - Very positive: 5
   Why?

2. How do you judge the possibility that customers can find information via a menu structure?
   - Very negative: 1
   - Very positive: 5
   Why?

3. Do you think it is necessary that customers can find information by browsing through a list of product or service names?
   - Not necessary: 1
   - Necessary: 5
   Why?

4. Do you think it is necessary that customers can find information by entering key words in search fields?
   - Not necessary: 1
   - Necessary: 5
   Why?

5. Do you miss any retrieval facilities? Why?

Do you have any additional remarks about the CD-i demonstrator?

THANK YOU FOR FILLING IN THE EVALUATION FORM!

C.5.2. Results

<table>
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<th>No.</th>
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Table 48: Overview results of CD-i questionnaire

234
C.6. The Viability of Multimedia Teleshop Services

C.6.1. Questionnaire

(The introduction of the questionnaire included a motivation for this survey, and an explanation of the basic terms multimedia, teleshopping and teleservices and other terms used in the scenarios. Further, the introduction explained the structure of the interview session, the structure of the questionnaire and the types of questions).

Evaluation of a multimedia user interface

M1. Do you think that this kind of user interface is worse or better than a text based interface like Teletext, Videotex or Minitel?

   Much worse  1--------2--------3--------4--------5
   Very Negative 1--------2--------3--------4--------5
   Much better

M2. How do you judge the addition of video to the user interface?

   Very Negative 1--------2--------3--------4--------5
   Very Positive

M3. How do you judge the addition of speech to the user interface?

   Very Negative 1--------2--------3--------4--------5
   Very Positive

M4. How do you judge the addition of colour pictures to the user interface?

   Very Negative 1--------2--------3--------4--------5
   Very Positive

M5. How do you judge the addition of music to the user interface?

   Very Negative 1--------2--------3--------4--------5
   Very Positive

M6. How do you judge the addition of animations to the user interface?

   Very Negative 1--------2--------3--------4--------5
   Very Positive

M7. Do you think multimedia is useful for marketing and males?

   0 Yes   0 No

Explanation:

Scenario I: a multimedia teleshop service in 1994

It is possible to establish a multimedia teleshop service with current technology, however, the multimedia information market it still in its infancy, and only 25% of all information is accessible in digital form. In business environments 30% of all computers are part of computer networks. 1% of the desktop computers are suitable for multimedia; on the consumer market this percentage is lower: 0.3%.

Most of the multimedia data of a teleshop service is stored locally on a PC or on a Tele-CD-i. The service provider can partly provide his multimedia information on-line or choose to electronically update the local database on the PC of the user. Tele-ordering is supported by the teleshop service. It is also possible to send or retrieve some additional information.

Both the service provider and the user will incur costs to offer the service or to get access to the service. The various costs are given in the table below, a range is given for each cost to indicate that depending on certain choices the costs will vary between these limits.

235
<table>
<thead>
<tr>
<th></th>
<th>User</th>
<th>Service provider</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial costs</strong></td>
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<td>DFL. 150,000,- to 500,000,-</td>
</tr>
<tr>
<td><strong>Monthly costs</strong></td>
<td>none</td>
<td>DFL 3,000,- to 10,000,-</td>
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<tr>
<td><strong>Communication costs</strong></td>
<td>0 cents</td>
<td>40 cents</td>
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<tr>
<td>(per minute, negative means yields)</td>
<td>to</td>
<td>to</td>
</tr>
<tr>
<td></td>
<td>DFL 1</td>
<td>-70 cents</td>
</tr>
</tbody>
</table>

1. **How do you judge the possibility that a multimedia teleshop service will create extra revenues?**
   - Very unlikely: 1---------2--------3--------4--------5
   - Very likely:    5

2. **How do you think a multimedia teleshop service will affect your margin?**
   - Very negative: 1---------2--------3--------4--------5
   - Very positive: 5

3. **How do you judge the possibility to reach new customers by a multimedia teleshop service?**
   - Very unlikely: 1---------2--------3--------4--------5
   - Very likely:    5

4. **Do you expect to meet the ROI requirement for a multimedia teleshop service for your company?**
   - Certainly not: 1---------2--------3--------4--------5
   - Certainly yes: 5

5. **Do you expect to gain market share by such a service?**
   - Certainly not: 1---------2--------3--------4--------5
   - Certainly yes: 5

6. **Do you expect to improve the quality of your customer services?**
   - Certainly not: 1---------2--------3--------4--------5
   - Certainly yes: 5

7. **Do you think that the 1994 scenario is realistic?**
   - 0 Yes 0 No 0 Don't know

8. **If not, which aspects are not realistic?**

9. **Do you think a multimedia teleshop service is viable for your company today?**
   - 0 Yes 0 No
   - Explanation:

10. **In general, do you think a multimedia teleshop service is viable today?**
    - 0 Yes 0 No
    - Explanation:

**Scenario II: a multimedia teleshop service in 1999**

The multimedia information market has grown out of its infancy. In 1999, a lot of independent multimedia information systems are developed and an increasing number of multimedia information systems are connected to other systems, e.g. financial and administrative systems. 95% of all information is digitally accessible and a total of 25% of all information is no longer accessible in its traditional form.

By 1999 all companies and about 20% of all families have a digital telephone connection at their disposal and its possible to distribute Full-Motion-Full-Screen video by such a digital connection, video requires a lot of transmission capacity. The transmitted video quality is comparable to super-VHS video quality and the audio quality is comparable to CD quality. About 80% of the computers in business environments and 20% of the computers at home are suit to multimedia.
It is possible to store almost all multimedia data at the service provider's host computers, due to the increase in transmission capacity of the different communication facilities. Service providers can keep their central multimedia information bases always up to date. The investment necessary to obtain access to a multimedia teleshop service has decreased for the end user.

Below you see the different costs in a table, once again.

<table>
<thead>
<tr>
<th></th>
<th>User</th>
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</tr>
</thead>
<tbody>
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<td>DFL. 100.000,- - 400.000,-</td>
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<td>DFL 2.000,- - 8.000,-</td>
</tr>
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<td><strong>Communication costs</strong></td>
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<td>30 cents</td>
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<tr>
<td>(<strong>per minute, negative means yields</strong>)</td>
<td>to 80 cents</td>
<td>to -60 cents</td>
</tr>
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</table>

1. Do you think your company will have a multimedia teleshop service in 5 years time?
   - Certainly not 1 -------- 2 -------- 3 -------- 4 -------- 5
   - Certainly yes

2. How do you judge the possibility that a multimedia teleshop service will create extra revenues in 1999?
   - Very unlikely 1 -------- 2 -------- 3 -------- 4 -------- 5
   - Very likely

3. How do you think a multimedia teleshop service will affect your margin in 1999?
   - Very negative 1 -------- 2 -------- 3 -------- 4 -------- 5
   - Very positive

4. How do you judge the possibility to reach new customers by a multimedia teleshop service in 1999?
   - Very unlikely 1 -------- 2 -------- 3 -------- 4 -------- 5
   - Very likely

5. Do you expect to meet the ROI requirement for a multimedia teleshop service for your company in 1999?
   - Certainly not 1 -------- 2 -------- 3 -------- 4 -------- 5
   - Certainly yes

6. Do you expect to gain market share by such a service in 1999?
   - Certainly not 1 -------- 2 -------- 3 -------- 4 -------- 5
   - Certainly yes

7. Do you expect to improve the quality of your customer services by such a service in 1999?
   - Certainly not 1 -------- 2 -------- 3 -------- 4 -------- 5
   - Certainly yes

8. Do you think that the 1999 scenario is realistic?
   - 0 Yes 0 No 0 Don't know

If not, which aspects are not realistic?

9. Do you think a multimedia teleshop service is viable for your company in 1999?
   - 0 Yes 0 No
   - Explanation:

10. In general, do you think a multimedia teleshop service is viable in 1999?
    - 0 Yes 0 No
    - Explanation:
Scenario III: a multimedia teleshop service in 2004

The multimedia information market has developed into a mature and global market. All information can be accessed in digital form and 75% is no longer available in a traditional form. Public networks are upgraded towards data highways, offering the bandwidths necessary for multimedia applications. All telephone connections are ISDN-connections the price of which have decreased due to severe international competition. It is possible to transport Full-Motion-Full-Screen video to the home, and computer systems and television sets are equipped with a standard multimedia teleshop interface. This means that almost everybody can use multimedia teleshop services at home. All computers in the business market are also suitable for multimedia applications.

Once again the costs:

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<td><strong>DFL. 100.000,- - 200.000,-</strong></td>
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<tr>
<td><strong>Communication costs</strong></td>
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<td>20 cents</td>
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<tr>
<td>(per minute, negative means yields)</td>
<td>to 60 cents</td>
<td>to -45 cents</td>
</tr>
</tbody>
</table>

0. Do you think your company will have a multimedia teleshop service in 10 years time?
   Certainly not 1---------2--------3--------4--------5  Certainly yes

1. How do you judge the possibility that a multimedia teleshop service will create extra revenues in 2004?
   Very unlikely 1---------2--------3--------4--------5  Very likely

2. How do you think a multimedia teleshop service will affect your margin in 2004?
   Very negative 1---------2--------3--------4--------5  Very positive

3. How do you judge the possibility to reach new customers by a multimedia teleshop service in 2004?
   Very unlikely 1---------2--------3--------4--------5  Very likely

4. Do you expect to meet the ROI requirement for a multimedia teleshop service for your company in 2004?
   Certainly not 1---------2--------3--------4--------5  Certainly yes

5. Do you expect to gain market share by such a service in 2004?
   Certainly not 1---------2--------3--------4--------5  Certainly yes

6. Do you expect to improve the quality of your customer services by such a service in 2004?
   Certainly not 1---------2--------3--------4--------5  Certainly yes

7. Do you think that the 2004 scenario is realistic?
   0 Yes  0 No  0 Don't know
   If not, which aspects are not realistic?

8. Do you think a multimedia teleshop service is viable for your company in 2004?
   0 Yes  0 No
   Explanation:

9. In general, do you think a multimedia teleshop service is viable in 2004?
Appendix C. Questionnaires and results

0 Yes 0 No
Explanation:

General questions
1. Do you think a multimedia teleshop service is a useful addition to your marketing instruments?
   Very useless 1---------2---------3---------4---------5  Very useful
2. How important is the innovative image of a multimedia teleshop service from a marketing point of view?
   Very unimportant 1---------2---------3---------4---------5  Very important
3. How important is the inclusion of automatic payment functionality in the multimedia teleshop service?
   Very unimportant 1---------2---------3---------4---------5  Very important
4. Is it important whether your competitors offer a multimedia teleshop service to their customers?
   Very unimportant 1---------2---------3---------4---------5  Very important

C.6.2. Results

<table>
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<th>Question</th>
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<th>Group II</th>
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<td>-0.62</td>
<td>.546</td>
</tr>
<tr>
<td>III.4</td>
<td>3.83</td>
<td>3.60</td>
<td>17</td>
<td>0.56</td>
<td>.582</td>
</tr>
<tr>
<td>III.5</td>
<td>3.44</td>
<td>3.80</td>
<td>17</td>
<td>-0.84</td>
<td>.411</td>
</tr>
<tr>
<td>III.6</td>
<td>4.22</td>
<td>4.50</td>
<td>17</td>
<td>-0.59</td>
<td>.560</td>
</tr>
<tr>
<td>Mean III</td>
<td>3.82</td>
<td>3.95</td>
<td>17</td>
<td>-0.35</td>
<td>.731</td>
</tr>
</tbody>
</table>

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### Table 49. Comparison between group I (running a Videotex service) and group II (inexperienced companies).

<table>
<thead>
<tr>
<th>Question</th>
<th>Group I</th>
<th>Group II</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.1</td>
<td>3.83</td>
<td>4.40</td>
<td>17</td>
<td>-1.26</td>
<td>.226</td>
</tr>
<tr>
<td>G.2</td>
<td>3.56</td>
<td>3.85</td>
<td>17</td>
<td>-0.51</td>
<td>.616</td>
</tr>
<tr>
<td>G.3</td>
<td>4.56</td>
<td>4.40</td>
<td>17</td>
<td>0.44</td>
<td>.666</td>
</tr>
<tr>
<td>G.10</td>
<td>4.22</td>
<td>3.85</td>
<td>17</td>
<td>0.74</td>
<td>.472</td>
</tr>
</tbody>
</table>

### Table 50. Comparison between group I (running a Videotex service) and group II (inexperienced companies) using the $\chi^2$ statistic for testing independence.

<table>
<thead>
<tr>
<th>Question</th>
<th>Group I</th>
<th>Group II</th>
<th>df</th>
<th>$\chi^2$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.7</td>
<td>100%</td>
<td>100%</td>
<td>1</td>
<td>1.02</td>
<td>NS</td>
</tr>
<tr>
<td>I.7</td>
<td>89%</td>
<td>70%</td>
<td>1</td>
<td>1.02</td>
<td>NS</td>
</tr>
<tr>
<td>I.9</td>
<td>22%</td>
<td>20%</td>
<td>1</td>
<td>1.02</td>
<td>NS</td>
</tr>
<tr>
<td>I.10</td>
<td>11%</td>
<td>10%</td>
<td>1</td>
<td>1.02</td>
<td>NS</td>
</tr>
<tr>
<td>II.7</td>
<td>78%</td>
<td>70%</td>
<td>1</td>
<td>1.02</td>
<td>NS</td>
</tr>
<tr>
<td>II.9</td>
<td>78%</td>
<td>80%</td>
<td>1</td>
<td>1.02</td>
<td>NS</td>
</tr>
<tr>
<td>II.10</td>
<td>89%</td>
<td>90%</td>
<td>1</td>
<td>1.02</td>
<td>NS</td>
</tr>
<tr>
<td>III.7</td>
<td>44%</td>
<td>70%</td>
<td>1</td>
<td>1.02</td>
<td>NS</td>
</tr>
<tr>
<td>III.9</td>
<td>89%</td>
<td>90%</td>
<td>1</td>
<td>1.02</td>
<td>NS</td>
</tr>
<tr>
<td>III.10</td>
<td>100%</td>
<td>90%</td>
<td>1</td>
<td>1.02</td>
<td>NS</td>
</tr>
</tbody>
</table>
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About the author

Martijn Hoogeveen was born on February 11, 1963 in Amsterdam. He attended the Montessori Lyceum in Amsterdam from 1975 to 1981 and went on to study Psychology at the University of Amsterdam from 1984 to January 1988, where he showed a growing interest in Social Science Informatics. In 1989 he attended a postdoctoral course in Information Analysis and Policy at the Academy of Informatics/University of Utrecht while working as a freelance database manager for the International Data Corporation in Amsterdam. After this, he worked as a system analyst for Informatics Project Management in Hoofddorp, specialised in travel agency automation. To broaden his scope he joined Cap Gemini Pandata/Multimedia Systems and participated as a system programmer and information analyst in the development of OCTOPUS - the criminal investigation system of the Dutch police’s criminal investigation departments - and a document retrieval system for Elf Acquitaine Norway. During this time he published a number of articles in specialist journals and started his Ph.D. research at Delft University of Technology.

In April 1992, he moved to PTT Research to deepen his multimedia Ph.D. research and became the project leader of a number of multimedia projects directed at improving support of marketing and sales, and multimedia publishing. From April 1992 to March 1993 he participated in and became task leader within the IMS1 EURESCOM project, specifying a pan-European multimedia teleservice. Currently he participates actively in multimedia business development within PTT Telecom BV in The Hague.
Samenvatting (Summary in Dutch)

Dit proefschrift is de neerslag van mijn onderzoek naar de *levensvatbaarheid van Multimedia Retrieval Systemen (MRS’en)* voor *Marketing & Sales (M&S)-toepassingen*. Multimedia houdt in dat meerdere informatietypen zoals spraak, muziek, tekst, plaatjes, animaties en video, op een geïntegreerde manier gebruikt worden. MRS’en voor M&S zijn multimediaystemen met een duidelijk onderscheidbaar informatie-ontsluitingsmechanisme, die één of meerdere M&S processen ondersteunen.

Bij aanvang van het onderzoek leek M&S één van de meest levensvatbare toepassingsgebieden voor multimediatechnologie. Levensvatbaarheid - de mate waarin systemen in staat zijn om te overleven onder bedrijfsomstandigheden - is een essentieel onderwerp voor iedere investeerder in multimediaystemen. Om deze redenen richtte dit onderzoek zich op het vergroten van het inzicht in de levensvatbaarheid van MRS’en voor M&S, en factoren die de levensvatbaarheid beïnvloeden. Dit inzicht kan verder bijdragen aan de verbetering van deze systemen, en de wijze waarop deze systemen ontwikkeld worden. Aan de hand van gevalstudies is een overzicht van potentiële levensvatbare MRS’en voor M&S opgebouwd en worden achtereenvolgens per MRS de bedrijfsmatige, functionele en implementatie-aspecten besproken. De MRS’en die door mij besproken worden zijn een Multimedia Marketingcommunicatie Archief voor de opslag en ontsluiting van bedrijfsbreed gebruik advertentiemateriaal, een Tele Sales Assistent ter ondersteuning van telefonische verkopers, een Multimediale Zakelijke Catalogus die de mogelijkheid biedt aan zakelijke klanten om te tele-orderen, een Multimediaal Promotie Systeem op een beurs, Multimediaal Ondersteund Onderwijs voor het opleiden van M&S personeel, en de Virtuele Markt. De Virtuele Markt, een digitale marktplaats langs de informatiesnelweg, is het meest tot de verbeelding sprekend systeem, aangezien het een flexibele ondersteuning biedt voor alle mogelijke typen van informatiediensten en bovendien tegemoet komt aan de behoeften van zeer heterogene groepen aanbieders en klanten.

Beschrijving van experimenteel onderzoek met betrekking tot de toegevoegde waarde van multimedia, en de resultaten van een kwalitatieve survey met betrekking tot zakelijke doelen en succes-/faalfactoren binnen onderzochte projecten, leveren inzicht op in de levensvatbaarheid van MRS’en voor M&S.

Experimenteel onderzoek geeft aan dat een belangrijke toegevoegde waarde van multimedia de amusementswaarde is, mensen zien multimedia als leuk en aantrekkelijk. De positieve attitude ten opzichte van multimedia heeft bij velen de vorm van een multimediageloof, een multimediaparadigma, aangenomen; dit paradigma behoeft echter aanpassing aangezien de
effectiviteit van multimedia en multimedia retrieval vaak wordt overschat. De effectiviteit van multimediasystemen kan lang niet altijd aangetoond worden. Onderzoek suggereert dat multimediasystemen vooral effectief zijn voor informatie- en kennisverdracht wanneer een juist niveau van multimedialiteit gecombineerd wordt met een hoog niveau van mens-machine-interactie, een adequaat gebruik van mentale referentiemodellen, een hoge informatiepresentatie-kwaliteit, en een congruent gebruik van de verschillende informatietypen (audio, video, tekst, plaatjes, enz.).

Sommige succes-/faalfactoren, die als kritisch gezien worden voor de levensvatbaarheid van MRS’en voor M&S, zijn óók multimediaspecifiek: voorbeelden van zulke succes/faalfactoren zijn: de technische complexiteit van multimediaprojecten, de schaarste van noodzakelijke multimedia-expertise, een gebrek aan standaardisatie van multimediaprodukten en de innovatieve uitstralings van multimediasystemen.

De resultaten van expertbeoordelingen en kosten-baten-analyses suggereren dat de meeste MRS’en vandaag de dag levensvatbaar zijn, en dat ze gezien worden als effectief. In het geval van het Multimedaal Marketingcommunicatie Archief en de Multimedaal Zakelijke Catalogus voor bestellen op afstand is zelfs aannemelijk gemaakt dat een zeer hoog rendement mogelijk is.

Alleen de Virtuele Markt kan vandaag de dag nog niet als economisch effectief en levensvatbaar gezien worden; experts geloven dat het nog zo’n 5-10 jaar duurt voordat dit wél het geval is. Dit betekent dat multimedia-uitvoerders en M&S-bedrijven die de verschuiving van servicecompetitie naar informatiecompetitie in de volgende eeuw willen overleven, zich ní al op de Virtuele Markt moeten gaan voorbereiden, om klaar te zijn voor een ontluikende markt over zo’n 5 jaar, en een winstgevende markt over zo’n 10 jaar.
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