

# A Maturity Model for Maintenance Departments of Public Organisations

An adaptation of the EFQM model



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## Preface

*“Shoot for the moon. Even if you miss, you'll land among the stars”  
- Norman Vincent Peale -*

This research discusses about the development of a maturity model for maintenance departments of public organisations. This thesis report started in September 2014 as a part of the Master graduation research projects at the Department of Real Estate and Housing of Architecture, Urbanism and Building Science Faculty at Delft University of Technology.

This research topic is derived from the increasing awareness of public organisations to perform professionally in managing their assets. Therefore, maintenance departments as parts of the public organisations should improve their capabilities in performing maintenance. The problem is there are no measurement tools that specifically develop to measure the maturity of maintenance departments in managing their organisations and in delivering maintenance. The aims of this research are to trigger the maintenance departments to start thinking and to enhance their knowledge toward the professionalism in maintenance departments. The results of this research are depicted in the thesis chapters.

Firstly, I would like to thank my mentors Marleen Hermans and Ad Straub for the guidance, feedbacks, and supports during my research. I would also thank to all my interview respondents for their valuable knowledge sharing, and become the important parts of the development of the maturity model in this research. Furthermore, I would like to thank to Pieter Eisma and Matthijs Prins that support me during the first development of my research proposal. Next, I would thank to all my professors during my study in TU Delft, my family, and friends who always support me, and give me positive influences for doing this research. Finally, I hope that this thesis report will benefit for the knowledge and science in the management of the built environment area.

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## Summary

The growing awareness of delivering public services into more customer-oriented minded triggers the public organisations to manage their assets professionally. Building assets are one of the resources owned by the public organisations that need to be maintained. Maintenance departments are part of the public body that have responsibilities to make sure that the building assets are functioning well and can perform for what it is designed for. The problems arise when there are many buildings that should be managed within different functions and types; such as monumental buildings, schools, offices, etc. creates complexities. Furthermore, the nature of public organisations is different compared to private organisations. Public organisations must follow the law and regulations, facilitating stakeholders' opinions and politics, and satisfying public. It is questioned whether the maintenance departments are capable to perform the maintenance activities professionally.

In order to reveal the capabilities of an organisation a measurement tool is needed. One of the measurement tools that can disclose the professionalism of organisations is a maturity model. With maturity model, an organisation can understand their current maturity level and design their strategy to reach the next level. Furthermore, this is a self-assessment tool that is simple to use. A maturity model can consist of several levels of five, six, or seven, that will depend on the desired function. It is believed that the higher the level, the more professional is the organisation.

Several quality management tools are being used by many organisations to enhance their professionalism, for instance the EFQM model. The EFQM model is commonly used in Europe that has components of "enablers" and "results". By using those components, organisations can value their performances and processes.

The main purpose of this research is to develop a maturity model that can measure the capabilities of maintenance departments. By having this tool that specifically designed for building maintenance departments, they can design strategies that fit their goals. Furthermore, to narrow down the research, the subjects of Planned preventive maintenance and Responsive maintenance are involved.

To develop a maturity model as an adaptation of the EFQM model, there are several steps to do. Firstly, the literature reviews are conducted. The topics that have to be explored are the types of maturity models, the EFQM model, and the activities of maintenance departments include the Planned preventive maintenance and Responsive maintenance. There are two maturity models that become main references; the Capability Maturity Model (CMM) by Paulk et.al (1993) and the Public Commissioning Maturity Model (PCMM) by Hermans et.al (2014). The main important aspects of the maintenance departments are then summarised and linked to those maturity models and the EFQM enablers. The result is the proposed maturity model.

Secondly, the first round interviews are conducted to get opinions and feedbacks from the experts about the proposed maturity model. This will find the relevancy of the key aspects in the model. The results of these interviews are the proposed maturity model and maturity levels. The third step in this research is to design an assessment sheet that can be used to measure the maturity level. This proposed assessment sheets are consisting of 26 questions with five multiple choices for each question.

The fourth step is to carry on the second round interviews to explore whether the proposed assessment sheet is relevant to test maintenance departments. The results of the interviews improve the questions and the multiple answers, which are improving the maturity levels. Finally, as final products of this research, a maturity model for maintenance departments and an assessment sheet are formed. The final maturity model consists of five main aspects, 20 sub aspects, and five levels for every main aspects and sub aspects. The final assessment sheet is consisting of 27 questions with five multiple answers per question.

## Table of Contents

Preface.....	3
Summary .....	4
Table of Contents .....	5
CHAPTER 1 .....	9
INTRODUCTION.....	9
1.1 Problem Statement.....	9
1.2 Research objectives and goals.....	10
1.3 Research Questions .....	11
1.4 Research Design.....	12
1.5 Research Methods.....	13
CHAPTER 2 .....	17
LITERATURE REVIEWS.....	17
2.2 The Maturity Models .....	17
2.2.1 What is a maturity model? .....	17
2.2.2 How to develop a maturity model?.....	18
2.2.3 How to use a maturity model? .....	18
2.2.4 Existing maturity models specific for maintenance .....	19
2.1 The EFQM model .....	21
2.1.1 The EFQM Enablers and Results criteria (EFQM, 2012) .....	22
2.2.2 The EFQM enablers for public organisation organisations.....	23
2.3 Maintenance departments .....	24
2.3.1 What is maintenance? .....	24
2.3.2 What are maintenance objectives and goals?.....	24
2.3.3 The Role of maintenance departments.....	25
2.3.4 Organisations and Stakeholders.....	25
2.3.5 Maintenance Policy .....	27
2.3.6 Maintenance Strategies .....	28
2.3.7 Suppliers performances.....	34
2.3.8 Innovation.....	35
2.4 Conclusions .....	36
CHAPTER 3 .....	39
MATURITY ASPECTS AND MATURITY LEVELS.....	39
3.1 Important aspects in maintenance department.....	39
3.2 Relationships between the EFQM model and key aspects of maintenance departments.....	42
3.3 The proposed maturity aspects and maturity levels .....	47
3.4 Conclusions .....	53
CHAPTER 4 .....	55
INTERVIEWS FINDINGS .....	55
4.1 Interview respondents.....	55
4.2 Important aspects of Maintenance departments.....	57

4.3 The EFQM enablers .....	58
4.3.1 Processes & Services enablers .....	59
4.3.2 Partnership & Resources .....	60
4.3.3 Leadership .....	62
4.3.4 People.....	63
4.3.5 Strategy.....	64
4.3.6 Conclusions for the maturity main aspects and sub aspects.....	65
4.4 Maturity Levels .....	65
4.4.1 The general maturity levels according to interviews respondents.....	65
4.4.2 Evaluation of proposed maturity levels by interview respondents.....	66
4.5 Conclusion .....	70
CHAPTER 5 .....	74
DESIGNING THE MATURITY MODEL .....	74
5.1 The development of maturity levels .....	74
5.1.1 General maturity levels .....	75
5.1.2 Maturity levels of Processes & Services .....	76
5.1.3 Maturity levels of Partnerships and Resources.....	78
5.1.4 Maturity levels of Leadership .....	81
5.1.5 Maturity levels of People .....	84
5.1.6 Maturity levels of Strategy .....	86
5.2 The new maturity model vs. the proposed model.....	87
5.3 Conclusions .....	87
CHAPTER 6 .....	90
DESIGNING THE ASSESSMENT SHEET .....	90
6.1 Respondents view toward the proposed assessment sheet.....	91
6.2 Discussion about the assessment sheet .....	94
6.3 Conclusion for this chapter.....	94
CHAPTER 7 .....	97
RESEARCH RESULTS AND DISCUSSIONS.....	97
7.1 Change from proposed to final maturity model and assessment sheet.....	97
7.2 The maturity model .....	97
7.2.1 The Maturity Levels of Sub aspects .....	100
7.3. The Assessment sheet .....	105
7.4 How to use the final Maturity Model.....	112
7.5. Discussion .....	112
CHAPTER 8 .....	114
CONCLUSIONS AND RECOMMENDATIONS .....	114
8.1. Main findings .....	114
8. 2 Sub Research Question 1 .....	114
8. 3 Sub Research Question 2 .....	115
8. 4 Sub Research Question 3 .....	115

8.2. Thesis limitation.....	116
8.3. Further research recommendations.....	116
8.4 Reflection.....	117
Bibliography.....	119
APPENDICES.....	122
APENDIX I.....	122
APPENDIX II.....	129
APPENDIX III.....	132
APPENDIX IV.....	149

# INTRODUCTION

# 1

## CHAPTER 1

### INTRODUCTION

#### 1.1 Problem Statement

Public sector organisations are organisations that provide services for public that having different nature if compared to the private sector. Public organisations are not profit-oriented organisation, but with the development of society, knowledge, and globalisation nowadays, they are expected to give better services, and more professional. Therefore, public organisations currently aim for professionalism and good services. The purpose is not only aiming for the individuals and customer satisfactions, but public organisations also want the benefit from; cooperation between government agencies, building an effective organisational structure, and set benchmarks for private sectors (Ha & Lee, 2010).

In order to provide good facilities and services, public organisations should manage their assets professionally. Asset management is defined as “a coordinated activity of an organization to realize value from assets” (The Institute of Asset Management, 2014). One of the important assets owned by the public organisations is building assets.

Public building assets provide facilities, such as schools, hospitals, prisons, government offices, etc. Furthermore, there are monumental buildings that should be protected for its valuable histories. There are complexities in managing building assets such as the amount of the buildings, the types of buildings, and the building functions. In the Netherlands, there were more than 200 government-building assets that are built before the World War era, and more than 550 building assets were built after the 1950s (Central Government Real Estate Agency, 2014). It can be imagined that to manage these assets, professional organisations are needed.

The situations are more complex because there are many stakeholders involved and they have different interests. Furthermore, when the building assets are deteriorating, at the same time, they should perform its function and qualities. If the public organisations fail to maintain buildings, it may affect their functions, and reduce their value because of the deteriorations (Williamson, Williams, & Gameson, 2010). According to Audit New Zealand (2010) as cited in (Sapeciay, Wilkinson, & Costello, 2013) a good asset management is a part of the public organisation’s wider service, financial planning process, and will contribute to the management of a public entity business. Therefore, in managing public building assets, the ability of the organisations to considering many aspects are essential.

As we are now discussing building assets, Wordsworth (2001) as cited in (Mossel, 2008) mentioned that construction activities for building assets are included maintenance, alteration, conversion, replacement and additional. In order to protect building assets from deterioration, regular maintenances need to be performed. Maintenance is a solution where it can retain the defects of building assets, and keep functioning over it whole building life cycle. Maintenance is defined by the British Standard (BS) EN 13306 (BSI 201) as “The combination of all technical, administrative and managerial actions during the life cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function”. Hence, in this research, we focus on maintenance department that having the task of providing good maintenance services because the maintenance departments have important roles in keeping the building assets well functioning.

To deliver maintenance, the maintenance departments face other complexities because of technical and organisational matter such as the hierarchical organisations that avoiding smooth processes in providing maintenance, stakeholder interests, and the lack of knowledge in maintenance. Therefore, maintenance departments must obtain capabilities to perform maintenance services.

Capability according to Tsang, et al. (1999) is “ the ability to perform a specific function within a range of performance levels that may relate to capacity, rate, quality and responsiveness”. Nevertheless, in order to know the capability of maintenance departments, its current situation must be measured. Therefore, the maintenance department can design their strategies to enhance their qualities. Furthermore, by doing measurements, it can provide information about the ability of the organisation in performing maintenance activities, in order to control it and to help the decision-making process. By identifying the strengths and weaknesses, they can focus to improve it. In addition, by performance measurement it also provides a motivational tool that forcing actions to support strategies (Tsang, Jardine, & Kolodny, 1999).

Several tools are developed as a benchmark for the organisations to improve their performances, such as six sigma, performance benchmarking, maturity models, etc. In this research, we are focusing on a Maturity model because of its simple use. Maturity models are one of the benchmarking tools that can reveal the key elements of the organisations performances. By using a maturity model, organisations can depict their current performances and plan strategies to reach the next level of maturity.

Another assessment tool that can be used to assess organisation’s professionalism is the EFQM model. This model is developed by The European Foundation for Quality Management Excellence (EFQM), and aims to make people understand the cause and effect relationships in an organisation toward what it does and the results it achieved (EFQM, 2012). By using the EFQM model as a parameter of professionalism in maintenance departments, we can design a maturity model. We use the EFQM model in this research because it has elements that are suit to be used in many types of organisations.

Currently there is limited knowledge about maturity models for maintenance departments of public organisations. The knowledge gap is a challenge and an opportunity for the researcher to explore this area. Therefore, it is essential to design a maturity model that specifically for maintenance departments.

## 1.2 Research objectives and goals

The objectives of this research is to increase awareness and thought toward improving professionalism at maintenance departments of public organisations. In order to make maintenance departments of public organisations aware about professionalism, we will design a maturity model in this research. The goals of this research are to set up a Maturity model for maintenance department of public organisations, and develop its assessment sheet. The focuses of this research are on the process of Responsive maintenance and Planned Preventive maintenance at maintenance departments of public organisations. This focus on those two types of strategies is because of the maintenance departments commonly use those two main types of maintenance strategies. Furthermore, by understanding the different processes of those two strategies, a more relevant maturity model can be created.

### 1.3 Research Questions

The research questions are meant to answer the expected results. The main research question will be:

***What are the important aspects of maintenance organisations can be used to develop a Maturity model for maintenance departments of public organisations?***

To support the main research questions, sub research questions are formulated as follows:

1. *“What are the important criteria of maintenance departments of public organisations?”*

- *What can be seen as important from the objectives, roles, tasks, and activities of maintenance departments of public organisations?*

This sub research question will guide the researcher to reveal the aspects of maintenance departments that can support designing the maturity model. The answers will be described in chapter 2, 3, and interview results in chapter 4, and 6.

2. *“What quality improvement tools can be adopted to measure the maturity levels of maintenance departments of public organisations?”*

- *How does the approach of the EFQM model for the organisations?*
- *What maturity models can be implemented to design a maturity model for maintenance departments of public organisations?*

This sub question will help the researcher to review the available quality improvement instruments that can be used as the references in designing a new maturity model. The answers will be explained in chapter 2.

3. *“How can the EFQM model, the maturity models, and the important criteria of maintenance department are related?”*

- *What components of the models and the important criteria can be used to design a Maturity model for maintenance departments of public organisations?*
- *How does the development of the maturity levels?*

The answers will be explained in chapter 2, 3, 5, 6, and 7. This sub question will explore the method of combining the models, developing it, and designing a new maturity model and an assessment sheet for maintenance departments of public organisations.

## 1.4 Research Design

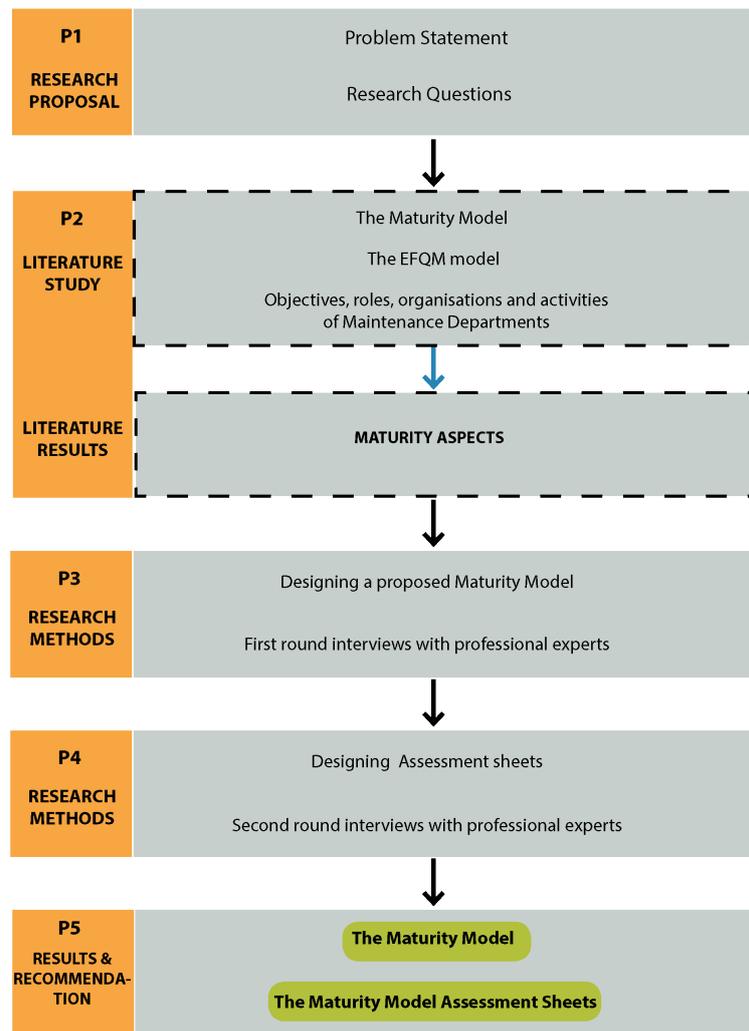


Figure 1 Research design

The diagram of research design above explains the process of this research. In P1 term, the problem statements and research questions are developed. The research questions are determining the types of research methods that will be used. In P2 term, literature studies are used as a method to gather information about maintenance departments, the EFQM model, and the maturity models. This method will result in the development of key aspects of maintenance departments. In P3 term, the research methods used are the first round interviews and designing the proposed maturity model. There are two rounds of interviews in this research. The first interviews are used as a method to check the relevancy of the proposed maturity model. Furthermore, this method can check the importance of each key aspect in the maintenance and gather more knowledge to design the maturity model. In P4, the research methods are designing the assessment sheet, and the second round interviews to check the applicability of the proposed assessment sheet. In P4 term, the results of the research will be presented. Therefore, the final conclusion and recommendation of this research will be delivered in P5 term.

## 1.5 Research Methods

As mentioned in the previous part, this research will use several methods; literature reviews, expert interviews, and designing the model. Literature reviews aim to gain general views toward the maintenance departments, the EFQM model, and maturity models; whereas the interviews objective is to obtain information from practitioners about the maintenance department's professionalism in public organisations. Designing a model is a way to deliver the final results of this research. By designing, a maturity model and assessment sheet for maintenance departments can be delivered.

### A. Literature Reviews

The literature reviews will focus on three areas:

1. The EFQM model

In this part, the criteria of Enablers in the EFQM model will be described.

2. Maintenance processes in maintenance departments

This literature review is focusing on the maintenance department's activities and processes, in the public organisation domain.

3. The Maturity Models

Literature reviews about maturity models are describing the process of using maturity models as assessment methods, and the concept of the level development. This literature reviews also describing different types of maturity models.

### B. Interviews

The second methods used in this research are interviews. There will be two rounds of interviews in this research. The first round interviews will focus on the relevance of the maturity aspects of maintenance departments, and the design of the proposed maturity model. The second round interviews will check the applicability of the proposed assessment sheet.

The respondents of these interviews are experts from different background, not only from public organisations, but also from private sectors, a research institution and a consulting firm. The purpose of taking professional from different background as respondents is to get broader perspectives toward the descriptions of a mature maintenance department. Furthermore, the respondents will also check the relevancy of the important aspects of maintenance departments, and the assessment sheet. In addition, most respondents of the interviews have had experiences working with public organisations.

The first round interview respondents are as follow:

#### Gemeente Delft (Municipality of Delft)

Municipality of Delft has a Real estate department in its organisation's structure (Gemeente Delft, 2015). The interview will be conducted with the key person to gain information about how the EFQM enablers are valuable for the maintenance activities in public organisations. The selection of this respondent is because of his expertise in the Real estate department that covering the task of maintenance. Furthermore, the medium size of the municipality can represent the size of works that should be done by the municipality, to maintain its real estate assets. There are many types of public buildings in Delft, such as monumental buildings, offices, that will enrich the respondent to share his knowledge about the maintenance experiences. In addition, for the researcher, the municipality of Delft is easy to access that will support the easiness of data collection.

### *Gemeente Rotterdam (Municipality of Rotterdam)*

The respondent from the Rotterdam municipality is chosen because of his expertise of working in the maintenance department. He is able to share his knowledge from the point of view of the maintenance departments of public organisations. The Rotterdam municipality represents the big scale of scope in managing building assets that related to its different types of stakeholders and buildings.

### Real Estate Management of TU Eindhoven

TU Eindhoven is an education institution that also a semi public organisation. The selection of expert from TU Eindhoven is because of the university is one of the public institutions. Furthermore, TU Eindhoven is one of university that own its Real estate management department that will enrich this research about the organisational structure and management in the university. In addition, TU campus emphasis innovation as part of their strategy, that might affect the maintenance department's performances.

### Real Estate Management of TU Delft

The Real estate management of TU Delft has a maintenance department that is responsible for the building assets in campus. The selection of the respondent from this organisation is because researcher wants to get more information from similar university institution to complete the data. Furthermore, the researcher wants to know whether any differences and similarity approaches in the maintenance department between TU Delft and TU Eindhoven. This can derive general conclusions toward the maintenance department of the University campus.

### Strukton as the supplier company

The expert from Supplier Company will give his opinions toward the maintenance department processes and activities from supplier's perspective. Strukton is one of the big construction companies in the Netherlands. The expert from this company can give opinions about the relationships with maintenance departments of public organisations. This company has had experiences working with public organisations; therefore, they can provide more objectives feedbacks that important for maintenance department's maturity.

### Kloet Onderhoud as the Supplier Company

Kloet Onderhoud is a medium-sized supplier company. The interview with expert from this company will make extensive views of Supplier Company. The perspective views of this company will provide information for the researcher to understand what is the maturity criteria meaning for them, and how the maintenance departments should act to be more mature and professional. It is expected that by interviewing a big size company and a smaller size company, it will enrich the knowledge about the maturity of maintenance departments.

The second round interviews respondents as follows:

### CBRE as the Real Estate Company

As a real estate company, expert from CBRE can give an objective opinion toward a professional maintenance department from the perspective of a private company. The selection of respondent from this company is because this company has a technical management department that provides maintenance services. Furthermore, the maintenance knowledge of a Private Sector Company can make the point of view toward the assessment sheet more objective and bring different insight. Expert from this company can check whether the assessment sheet developed in this research is appropriate to measure the maturity levels of maintenance departments of public organisations.

#### A Maintenance Consultancy Company

The expert from the consulting company has experiences working together with public organisations. Therefore, he can give information and knowledge about the nature activities of maintenance departments of public organisations. A consulting company knows what things that are needed by the maintenance departments of public organisations. Hence, he can assess whether the assessment sheet is relevant to test their maturity levels.

#### An expert from ISSO (Building Service Installation Research Institute)

The key person from ISSO is selected because of the experiences in designing, installation maintenance standard for public organisations in the Netherlands. Therefore, he can gives feedbacks into the assessment sheet, whether its structures can support the maintenance department in revealing their maturity levels.

#### *C. Designing the maturity model and assessment sheet*

Designing the maturity model and the assessment sheet are important for this research. The design of the maturity model should be simple and easy to be used. Furthermore, the design of the assessment sheet should be able to capture the maturity aspects and the maturity levels. In addition, during this research, the design of the proposed maturity model and the proposed assessment sheet must be delivered in advance before interviewing the respondents.

# LITERATURE REVIEWS

# 2

## CHAPTER 2

### LITERATURE REVIEWS

This chapter describes the literature reviews that are done by the researcher. The results of this literature review will lead to the next research method, which is designing the proposed maturity model.



Figure 2 First research step

In order to answer the research questions about the important criteria of maintenance departments, and the correlation between the maturity models and the EFQM model, we will use the literature reviews as a research method.

### 2.2 The Maturity Models

There are many quality improvement tools that can support maintenance departments increase their capabilities, but in this research, we will focus on the maturity models. The selection of this tool is because a maturity model is simple to use, and it explains the aspects and criteria that must be improved by the organisations. We will discuss about maturity models in the next parts bellows:

#### 2.2.1 What is a maturity model?

A Maturity model is an approach to assess the organisation's performances in managing its business process that consists of several key process areas and several maturity levels (Meng, Sun, & Jones, 2011). There are different types and functions of maturity models. According to Hermans, et al. (2014) there are several maturity models that related to the construction industry; for instance IM3 (Infrastructure Management Maturity Model), SCEMM (Supply Chain Excellence Maturity Model), MSU (Purchasing Excellence Publiek Model), IMT (Infra Maturity Tool), and Project Management Maturity Model. Schuh, et al. (2009) developed a maturity model for maintenance departments, mainly small and medium-sized enterprises (SME). Most of the maturity models are referring to the CMM (Capability Maturity Model) that was developed by Paulk, et al. (1993). The CMM is the pioneer of the maturity model that becomes a main reference of many maturity models' developments.

According to Meng et al. (2011) the key process areas refers to a cluster related activity that aiming a set of goals. The level of maturity describes the main characteristics of key business processes of organisations. Nevertheless, each maturity model has its different level development, for instance 5 levels, 6 levels, and 7 levels. The different level developments are according to its purposes. The Software Engineering Institute (SEI) of Carnegie Mellon University originally developed the maturity model in 1991 (Paulk, Curtis, Chrissis, & Weber, 1993). The first maturity model was intended to assess software development. Their maturity model is consisting of five levels. Currently other models are varied in determining their maturity level, such as the Software Maintenance Maturity Model (SM<sup>mm</sup>) that consists of six maturity levels.

There are advantages of organisations using the maturity models as an assessment tool. According to Nesensohn et al. (2013) those advantages are:

- Allow organisations to measure their current organisational capability, and allow them to apply a change or enhance strategy in an organised way.
- Delivers guidelines for people, and give information to select improvement actions, and starting a cultural change.
- Direct and augment the ability within an organisation to exploit a culture of excellence.
- Stipulate information that is important for organisations in planning and guiding their continuing transformation efforts.

### 2.2.2 How to develop a maturity model?

According to (April, Hayes, Abran, & Dumke, 2004) the first step to develop their maturity model was identifying specific organisation's activities. It is also important to first define the definition of the mature organisations (Paulk, Curtis, Chrissis, & Weber, 1993). The second step was surveying the standards, explores the literatures and other maturity models. As the result, the proposed maturity model then introduced.

### 2.2.3 How to use a maturity model?



Figure 3 The levels in maturity model (source: own interpretation, based on CMM by Paulk et.al, 1993)

The first concept to use maturity model is to understand the criteria of each level. Here is the example of five maturity levels. As it is explained in the figure above, each level has a name on it in order to make it simpler to categorise and state of the current organisation's situation.

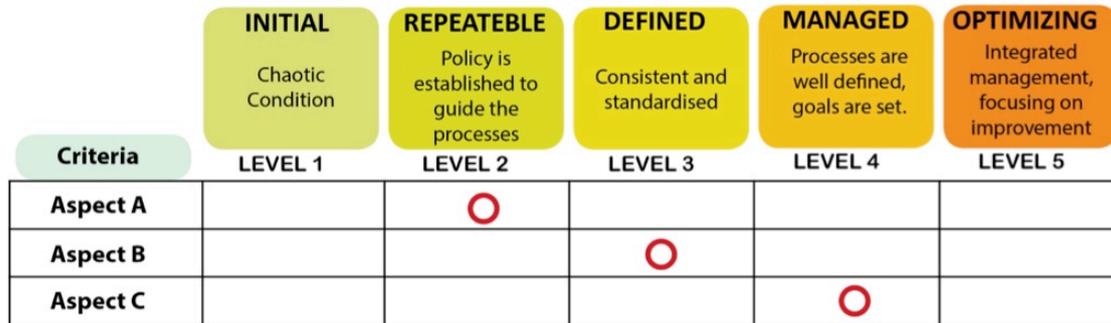


Figure 4 an example of five maturity level and its criteria (source: own interpretation, based on CMM by Paulk et.al, 1993)

The five levels above should be linked with the indicator/aspects of organisations' performances. For instance the aspect A of an organisation is currently on the maturity level two, while the aspect B is already in level three. The important thing is not on which level the organisation is, but more on the strategies and decisions in order to increase the level one step above. The approach of the maturity model is a step-by-step enhancement (Paulk, Curtis, Chrissis, & Weber, 1993). That means when a maintenance department already reached a certain level, they can design strategies to reach the next level, and not to leap into the highest level.

#### 2.2.4 Existing maturity models specific for maintenance

Based on the literature reviews of journal research, most of the maturity models are having purpose for assessing the software organisations such as the Capability Maturity Model (CMM) and the Software Maintenance Maturity Model (SM<sup>mm</sup>). There are also maturity models for construction industries such as the Project Management Maturity Model (PMMM) and the Construction Project Management Maturity Model (CPM3). Nevertheless, a specific maturity model for maintenance departments of the public organisations is not yet discussed. Here we will discuss the main references used in this research for designing a maturity model for maintenance departments.

##### A. Capability Maturity Model (CMM)

Paulk, Curtis, Chrissis, and Weber develop the Capability Maturity Model for Software Process in 1991. This is the first maturity model that currently becomes a reference for many researches. This maturity model consists of five maturity levels, in which the lowest level is "Initial", followed by "Repeatable", "Defined", "Managed", and "Optimized" as the highest maturity level (Paulk, Curtis, Chrissis, & Weber, 1993).

The maturity levels in the CMM are not prescriptive, this means that the maturity model does not tell an organisation how to improve, but it must appropriately interpreted by professional judgement. To reach the next level of maturity can takes several years.

There are four uses of the CMM stated in (Paulk, Curtis, Chrissis, & Weber, 1993):

- To identify strengths and weaknesses of the organisation.
- To identify the risks of selecting among different contractors.
- To understand the activities necessary to plan, and implement improvement programs for the organisation.
- The CMM as a guide to help defining and improving the process of the organisation.

The Key process areas in the CMM are described from level two to level 5. In level one, the key process areas are not yet formed because the organisation is in a chaotic condition. At every level, the key process areas are different, according to the need of the organisation itself. The key process areas in the CMM are described in the figure below.

This example is useful as a reference in organising the different processes in organisation of each level.

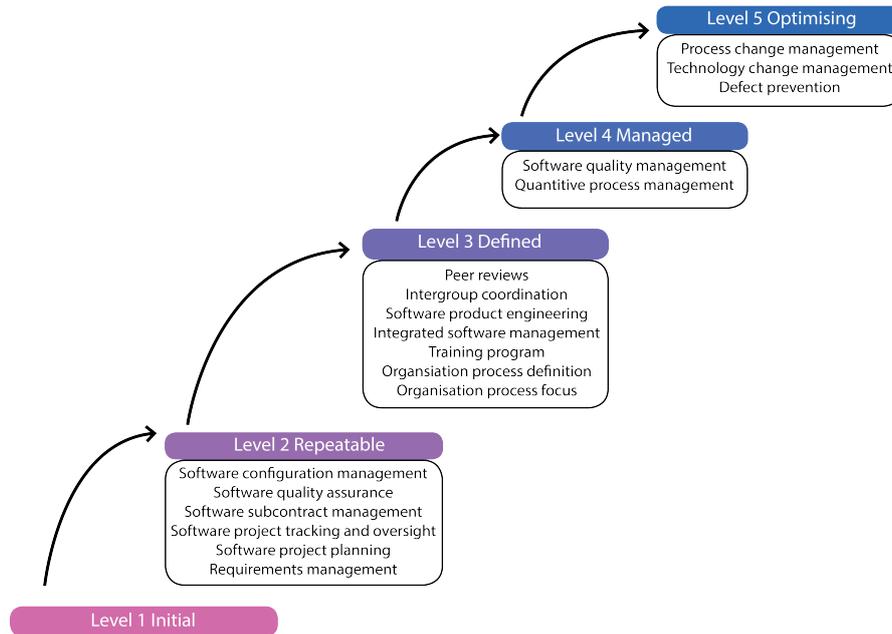


Figure 5 Example of the Key Process Areas by Maturity Levels (own illustration, source: Paulk, et. al, 1993)

### B. The Public Commissioning Maturity Model (PCMM)

The Public Commissioning Maturity Model (PCMM) is developed by Marleen Hermans, Leentje Volker, and Peter Eisma. This model is used to assess public organisation capabilities related to construction clients' roles in term of commissioning of successful construction projects (Hermans, Volker, & Eisma, 2014). This maturity model consists of five levels of maturity. The lowest level is "Ad Hoc", and then followed by "Repeatable", "Defined", "Managed", and "Optimized" as the highest maturity level. These levels are more or less similar with the CMM levels. In this research, the developing process of designing the PCMM is used as a reference and guidelines.

As it stated in Hermans et.al (2014), the process of developing the PCMM was started with literature reviews toward public commissioning in the built environment. Therefore, the elements related could be obtained, for instance, aspect of public values and governance. Afterwards, the literature review on maturity models was carried out. The results of the important elements of literature reviews then were summarised in excel sheets. Hence, the elements were categorised based on their similarities and differences that can lead to the development of the maturity model. Finally, those were resulting in a draft version of a maturity model.

The draft version is then discussed in expert sessions. Thus, could provide feedback for the existing draft version of the maturity model. Finally, the maturity model was formed that consists of ten main aspects, and several sub aspects. Those aspects are (Hermans, Volker, & Eisma, 2014):

Table 1 Public Commissioning Maturity Aspects (source: Hermans et. al, 2014)

<p><b>1. Organisational strategy and policy</b></p> <ul style="list-style-type: none"> <li>Objective and policy</li> <li>Improving and Innovation</li> <li>Change strategies</li> </ul>	<p><b>2. Culture and Leadership</b></p> <ul style="list-style-type: none"> <li>Governance and appraisal</li> <li>Culture related to innovation and professionalism</li> </ul>
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<p><b>3. People and Learning organisations</b></p> <ul style="list-style-type: none"> <li>• Knowledge, capacities and competences</li> <li>• Teams</li> <li>• Learning organisations</li> </ul>	<p><b>4. Decision models and portfolio</b></p> <ul style="list-style-type: none"> <li>• Decision models for commissioning options</li> <li>• TCO/LCC (total cost of ownership/Life cycle cost)</li> <li>• Project vs. portfolio</li> </ul>
<p><b>5. Stakeholders</b></p> <ul style="list-style-type: none"> <li>• Consequences of political context</li> <li>• Safeguarding interests and position of users and stakeholders</li> <li>• Trend and developments in stakeholder organisations</li> </ul>	<p><b>6. Public values</b></p> <ul style="list-style-type: none"> <li>• Public values in commissioning</li> <li>• Launching customer ship and setting an example</li> </ul>
<p><b>7. Public rules of play</b></p> <ul style="list-style-type: none"> <li>• Acting according to integrity</li> <li>• Transparency, effectiveness, legality rules</li> <li>• Procurement regulations</li> </ul>	<p><b>8. Interaction with the supply market</b></p> <ul style="list-style-type: none"> <li>• Market knowledge</li> <li>• Effective selection processes</li> <li>• Using the market's innovating power and knowledge</li> <li>• Interaction, partnership, collaboration</li> </ul>
<p><b>9. Managing projects and assignments</b></p> <ul style="list-style-type: none"> <li>• Stability and firmness of role</li> <li>• Professional variation in commissioning</li> <li>• Specifying, procuring, contracting, contract management.</li> </ul>	<p><b>10. Creativity and flexibility</b></p> <ul style="list-style-type: none"> <li>• Combining compliance and creativity: thinking out of the box.</li> </ul>

The Public Commissioning Maturity Model (PCMM) has ten aspects. Every aspect can be broken down into sub aspects in order to be relevant for the assessment.

In this thesis, we use the PCMM's sub aspects as references because of its function of measuring the public organisations. Furthermore, it is linked with the built environment areas. In addition, the process of developing the maturity model and the criteria of maturity aspects are related to the maintenance departments of public organisations.

## 2.1 The EFQM model

In the direction of developing the main aspects of maintenance departments, the EFQM model is used. This is because it has a common language that can be used by any organisations regardless its size or area (EFQM, 2012). The European Foundation for Quality Management Excellence (EFQM) model is a framework model that allows people to understand the cause and effect relationships in an organisation toward what it does and the results it achieves (EFQM). According to Hillman (1994) as cited by (Vukomanovic, Radujkovic, & Nahod, 2014) EFQM model was originally developed as a quality management system in 1991 by the European Foundation for Quality Management. The EFQM model consists of two criteria, "Enablers" and "Results". The Enablers criteria are

Leadership; People; Strategy; Partnerships and Resources; and Processes, Products and Services. The Results criteria are People Results, Customer Results, Society Results, and Business Results.

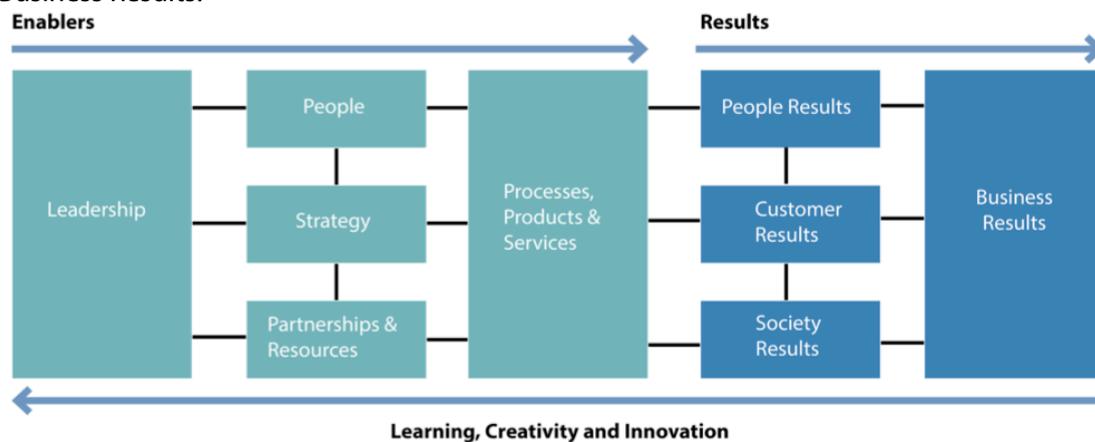


Figure 6 EFQM model (source: [www.efqm.org](http://www.efqm.org))

The diagram above shows the dynamic nature of the model. If the Enablers are effectively implemented, the organisations will reach the desired Results (EFQM, 2012). The arrows emphasise of always learning, and always improve the Enablers to achieve the expected Results. To achieve excellence performances, organisations can carry out a self-assessment based on those EFQM criteria above. Each criterion imply on the need for an organisation to change and actions to improve the capabilities (EFQM, 2012).

### 2.1.1 The EFQM Enablers and Results criteria (EFQM, 2012)

The “Enablers” of the EFQM model will be explained below:

1. Leadership  
The EFQM assessment will reveal the current leadership style, the level of leadership, the strengths in this area, and possibility of enhancement.
2. Strategy  
The assessment under the “strategy” criteria will help organisation on how the strategy of the organisation is developed, its effectiveness, and deployed.
3. People  
This is about how the organisation manages the people, identify, and improve the capabilities of the people. Moreover, it is important to involve and communicate with people in order to improve organisation in this area.
4. Partnerships and Resources  
This criterion is about understanding the level of organisation in managing partnerships and resources. Therefore, organisation can discover the opportunities to enhance this area.
5. Processes, Products and Services  
This criteria is about the organisation’s possible enhancements that can be achieved by taking process views, such as identifying key processes, building a process model of the organisation, managing and reviewing, rather than the traditional view.

The “Results” criteria are presented below:

1. Customer Results  
The EFQM assessment about this factor is to assess how effective is the organisation’s customer satisfaction survey and how good an organisation interpreting it.
2. People Results  
This criterion is about motivated and satisfied people because they are a resource that can change the organisation.
3. Society Results  
The society results means that everyone can have an impact and everyone can make the differences. The assessment will help the organisations to set indicators that are good in predicting the society results.
4. Business Results  
This criterion is underlined the business performance outcomes, the business performance indicators, and the importance of a culture of a measurement and results. The assessment will help to understand how the organisation’s indicators are, the strengths, and the areas for improvement.

Regarding the purpose of this research and the availability of data, we will use only the “Enablers” in the EFQM model as the main elements to be adopted in the maturity model for maintenance departments. The reason of only using the “Enablers” is because of the time limitation for this thesis. The “Results” factors can only be analysed when the organisations implement the “Enablers” criteria in their processes. The “Results” factors aim to check whether the “Enablers” can improve the organisations to be more professional. Therefore, for this thesis, implementing the “Enablers” is sufficient to develop the maturity model.

### 2.2.2 The EFQM enablers for public organisation organisations

The nature of public organisations is different if compared to private organisations. Nevertheless, the EFQM model’s instruments can also be implemented in public organisations. According to the document publication published by the EFQM organisation, it is necessary that the innovation agencies incorporate the management framework in order to align their strategies with the effectiveness of policy implementation (PRO INNO EUROPE, 2012). This is coherent to the nature of public organisations that must follow the regulations and policy application. Public organisations can implement the “Enablers” of the EFQM model for the areas as follows:

#### *a. Leadership*

The Leadership enabler in most cases of public organisations, related to the mission that is controlled by the political governance, and can change when the governments is changing. People working in a public organisation are also expected to show integrity. Therefore, the leaders have a critical role in decision-making (PRO INNO EUROPE, 2012). The leadership factor can focus on the ability of leader to adapt and flexible to the new changing and regulations.

#### *b. Strategy*

The Strategy enabler in public organisation is about assessing the ability of the maintenance departments defines the long-term strategies and specific strategies (PRO INNO EUROPE, 2012). These strategies should link with the structure of the organisations. In public organisation, the strategy design is related to the maintenance goals and budget (PRO INNO EUROPE, 2012).

### *c. People*

This enabler is related to the abilities of the people in the organisation to make a contribution, and make sure that stakeholders are satisfied. Furthermore, they must have public values such as integrity and transparency (PRO INNO EUROPE, 2012).

### *d. Partnership and resources*

This enabler is related to the agreement model and procedures as the obligation of public organisations. The ability of the organisation to manage their resources in order to achieve the organisation's mission is also essential to measure their accountability (PRO INNO EUROPE, 2012).

### *e. Processes, products, and services*

This enabler is related to the capabilities of the public organisation in developing effective and efficient approaches (PRO INNO EUROPE, 2012). In this research, the Enabler of Processes, Products and Services will only emphasise on Processes and Services, because of maintenance is focus on services and not on the term of products.

## **2.3 Maintenance departments**

To develop a maturity model for maintenance departments of public organisations, we must identify the important aspects of maintenance. In this part, we will describe important aspects and activities of maintenance departments from literature reviews. We emphasise on the literature reviews of two types maintenance strategies; the Planned preventive maintenance and the Responsive maintenance. Those two maintenance strategies are the main strategies that mostly used by the maintenance departments. Besides reviewing those strategies, we will also discuss other important activities and factors in maintenance. In addition, we will derive the important criteria of maintenance organisations from the literature reviews follows:

### **2.3.1 What is maintenance?**

Maintenance is defined by (British Standards Institution, 1993) as "The combination of all technical and associated administrative actions intended to retain an item in, or restore it to, a state in which it can perform its required function". This research focuses on the building maintenance as a part of a public organisation asset management. Therefore, the Building maintenance is defined as "Work undertaken in order to keep, restore or improve every facility, i.e. every part of the building, its services and surrounds to a currently acceptable standard and to sustain the utility and value of the facility" (Chanter & Swallow, 1996). From the definition of the building maintenance, it is obvious that the maintenance activities are meant to obtain the function and the value of the building facilities.

### **2.3.2 What are maintenance objectives and goals?**

Maintenance objectives can relate to the economy because it aims to provide high performances using the lowest costs. The objectives of conducting building maintenance according to (Alner & Fellows, 1990) as cited in (Horner, El-Haram, & Munns, 1997) are:

- To make sure that the buildings and their associated services are in a good condition;
- To maintain the value of the buildings as physical assets;
- To maintain the buildings in order to have good qualities to use, and meets all requirements.

Kans (2008) described the maintenance objectives at a tactical level and at a strategic level. At the tactical maintenance management level, the objectives of maintenance are; optimising schedules and inventories, and carry out the prioritised activities in order to reach effective utilisation. At the strategic level, the objectives of maintenance are to reach cost efficiency, and to reach general goals for the production, such as reliability, safety, etc.

In conclusion, the objective of maintenance management in general is enhancing plan and implementation, using applicable materials and tools at the right time, and minimising total life cycle cost, in order to prevent, to reduce, and to repair building defects (Horner, El-Haram, & Munns, 1997).

From this discussion about the objectives and goals of maintenance departments, the criteria of maturity aspects can be derived as "Maintenance departments are able to set clear maintenance objectives and goals". Furthermore, a mature maintenance department can "translate the objective and goals into actions". These criteria of a mature maintenance department, in the next chapter will be used in designing the maturity model.

### 2.3.3 The Role of maintenance departments

According to Haroun & Duffuaa (2009), the roles of maintenance departments are:

- Planning: The maintenance departments set performance objectives, and develop decisions on how to achieve them.
- Organizing: This means that the organisations should create a structure in which they divide the tasks and manage resource allocations. Moreover, organisations coordinate their activities to conduct maintenance tasks.
- Implementing: The maintenance departments execute the plans to meet the performance objectives.
- Controlling: The maintenance departments measuring performances of the maintained equipment, and taking the preventive or corrective actions in order to restore the desired specifications.

From this discussion, it can be concluded that the criteria of a mature maintenance department will be:

- Able to understand their role and responsibilities, and perform it.
- Able to perform maintenance planning and controlling.

### 2.3.4 Organisations and Stakeholders

According to the standard ISO/IEC 15288(2002) as cited by Söderholm et al. (2007), "a stakeholder is an interested party who have a right, share or claim in the system or in its possession of characteristics that meet that party's needs and/or expectations".

In performing maintenance, a maintenance department will have to cope with the stakeholders. In public organisations, there are many stakeholders involved in the process of maintenance. In maintenance, stakeholders who have interests within the processes are people who perform technical and administrative tasks; and external stakeholders who are interested in the required function of the building object. (Söderholm, Holmgren, & Klefsjö, 2007). The maintenance departments must consider the relationships with the internal stakeholders such as the public organisation in which the maintenance department is part of it, client organisations, end users, and suppliers. Whether the external stakeholders are, for instance are the political party, and the public. The Stakeholder relationships with maintenance departments in public organisations are described as follows:

#### *a. Public organisations*

Public organisations have an internal maintenance department that delivers the maintenance activities for their building assets. The purpose of a public organisation in having a maintenance department is to ensure that the building assets can perform well in facilitating clients and end-users. Public organisations monitor the performances of the maintenance department in delivering maintenance activities. Moreover, the public organisations provide standards for the maintenance activities, for instance the regulations and the procurement law to be used. The maintenance departments follow those standards in order to meet the requirements and fulfil the public organisation's objectives.

It is important that the goals of maintenance departments are integrated with the goals of the public organisations.

#### *b. Internal Client organisation*

Client organisations are organisations that need the services of the public organisations. Thus, the clients can also be from the internal organisation. The clients need the assistance of the maintenance departments in delivering maintenance services, because the clients want to satisfy the end-users.

#### *c. Maintenance department*

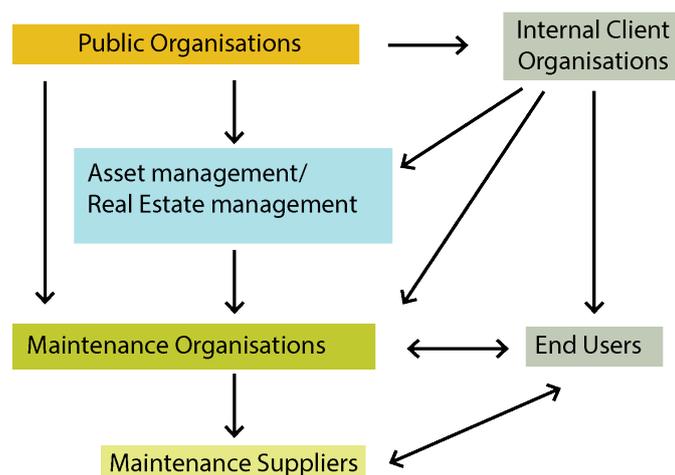
Maintenance departments are responsible for the maintenance processes and maintenance activities. The activities delivered by the maintenance departments include inventory, condition assessment, planning, procurement, purchasing, and controlling. The objectives of the maintenance departments are to fulfil the tasks given by the public organisations, as well as providing services for clients, and satisfying end-users. The maintenance departments, mostly outsources their works to the markets, unless for small activities.

#### *d. Maintenance Suppliers*

The maintenance suppliers are the contractors who execute the maintenance works. The contractors are selected through the procurement processes. In maintenance, the market of suppliers is fragmented. The maintenance suppliers that operate in the market are usually small company /SME (small and medium enterprise) that specialise in their disciplines.

#### *e. End-users*

The end users are the people who use the facilities provided by the public organisation. The end users of public organisations are from the internal organisations and the people outside of the organisations. The end users have different requirements based on the facilities and performances needed by them.



**Figure 7 Stakeholders relationships (source: own illustration)**

The relationships between the stakeholders are explained in the figure 7. The public organisation has a direct relationship with the Real estate management or Asset management, the Maintenance department, and the Internal client organisations. The public organisations serve the goals of the client organisations. On the other hand, the

maintenance department is executing the aims of the asset manager and the public organisation. Besides executing the tasks given by the public organisation and the asset management, the maintenance department also has an ancillary relation toward the internal client organisation. Furthermore, the processes of maintenance services are started by making inventory of the building assets owned by the clients. At this point, the maintenance department is responsible for its services to the internal clients.

As part of the process, the maintenance department must plan and procure in order to perform the maintenance activities. Thus, the maintenance department should select appropriate suppliers to fulfil the maintenance services. There are agreements and collaborations created between the maintenance department and maintenance suppliers. At the same time, both of the maintenance department and maintenance suppliers have a relationship toward the end-users. They should have a customer-oriented mind set in order to carry out good maintenance services and satisfy the end-users.

From this discussion, it can be concluded that the maintenance departments should consider their positions in the organisational structures to be able to manage the stakeholders. Furthermore, the strategies of managing stakeholders should in-line with the public organisation's strategies. The criteria of a mature maintenance department in this discussion will be:

- Capable in maintaining relationships with its stakeholders
- Able to capture client's requirements
- Considering end-users satisfactions
- Capable of selecting appropriate suppliers
- Able to maintain collaboration with all stakeholders
- Incorporating stakeholder opinions in decision making

### 2.3.5 Maintenance Policy

According to Lee & Scott (2009), the building maintenance policy is "a written document, and provides a management framework to the maintenance personnel to determine appropriate maintenance strategy and standard." There are important elements to build maintenance policy; those are the selection of maintenance strategies, defining the maintenance standard, and maintenance resource allocations (Lee & Scott, 2009). From this definition, the maintenance policy is having bigger scopes that not only focus on the physical aspects such as maintenance strategies, but also it is related to the management of the maintenance organisations. The maintenance policy is concerning the building standard, building life cycle, building types, length time for maintaining, the legal, and requirements (Lee & Scott, 2009). From these many aspects, the maintenance departments could deliver appropriate strategies for the maintenance services.

The general objective of maintenance policy based on British Standard (BS 8210) is described as: "A maintenance policy should ensure that value for money expended is obtained, in addition to protecting both the asset value and the resource's value of the building concerned and the owner against breaches of statutory and legal obligations" (Allen, 1993). By having a clear maintenance policy, the maintenance department can perform appropriate strategies that fit with the vision and mission of the public organisation.

According to the definitions above, it is important for maintenance departments to perform object evaluation before selecting maintenance strategies. Object evaluations are incorporating financial aspect and physical aspects. According to Straub (2011), the financial aspects of object assessment are including expected maintenance costs, energy costs, operational costs, etc. The data from financial evaluation is valuable in deciding the contractual types and decisions of the organisation's business. Nevertheless, object valuations tasks depend on the organisation's structures. Mostly it is the role of asset

management departments. However, it is also possible that the asset management also has maintenance tasks in its role.

Maintenance policy should be able to cover both the operational aspects, such as the maintenance strategies, and the tactical aspects such as the financial and functional aspects. The Maintenance policy is the integration of several strategies approaches (Horner, El-Haram, & Munns, 1997) that will be explained in the next part.

### 2.3.6 Maintenance Strategies

Selecting maintenance strategies are part of the controlling role of the maintenance departments. Maintenance strategy is defined by Dunn (2003) cited in (Lind & Muyingo, 2011) as “a long-term plan covering all aspects of maintenance management, which sets the direction for maintenance management, and contains firm action plans for achieving a desired future state for the maintenance function”. The maintenance strategies are part of the maintenance process in which the decision makers choose the preferred strategies based on their organisation’s priorities.

Maintenance strategies can be categorised in many different ways. In Europe, the standard used is EN 13306. In this European standard, the types of maintenance are divided into two types, Preventive maintenance is planned before a default detected, and Corrective maintenance that provided after defects are detected. Maintenance strategies in general are classified by (Horner, El-Haram, & Munns, 1997) as follow:

#### 1. Preventive maintenance (PM)

Preventive maintenance is the planned maintenance to avoid failures (Lind & Muyingo, 2011). This strategy is planned at a regular time based on operating time (Horner, El-Haram, & Munns, 1997). The advantages of preventive maintenance are (Horner, El-Haram, & Munns, 1997):

- Avoiding extra costs by avoiding sudden damage;
- It is convenient for building users by the scheduled plan;
- Minimize the downtime.

On the other hand, preventive maintenance also has disadvantages, when the task should be performed based on schedule time, regardless the actual condition, it will carry out unnecessary works and costs (Horner, El-Haram, & Munns, 1997); (Saranga, 2002).

#### 2. Corrective maintenance (CM)

Corrective Maintenance is a maintenance strategy that conducted only when the object of maintenance is broken or faults (Lind & Muyingo, 2011). This strategy is also described as an unplanned maintenance or a failure-based maintenance; furthermore, this strategy can be expensive (Horner, El-Haram, & Munns, 1997). According to Lind & Muyingo (2011), the difference between The Deferred CM and the Immediate CM is that the deferred CM occurs because is not carried out immediately after the defect on the object is detected because of the maintenance rules. On the other hand, the Immediate CM is immediately performed after the defects are detected.

#### 3. Condition-based maintenance.

A condition-based maintenance is performed based on the condition of the object building by monitoring and planned the building’s element/units (Horner, El-Haram, & Munns, 1997). The condition-based maintenance will be carried out based on a certain condition of the building object.

The model for maintenance strategies based on EN 13306 is provided in the figure 8.:

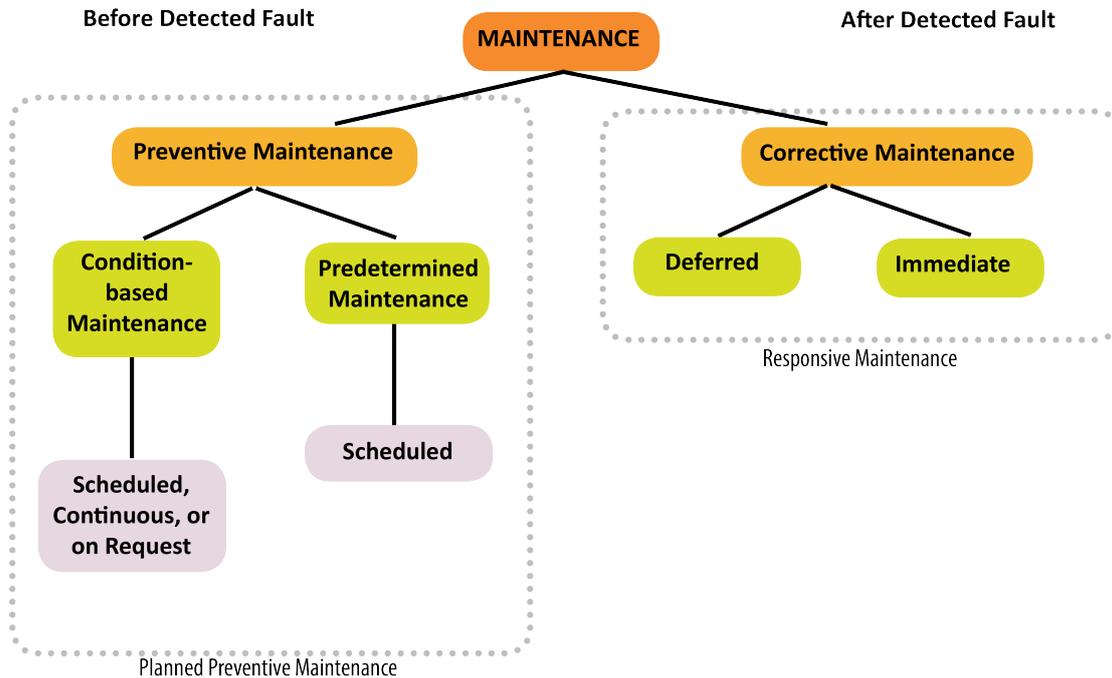


Figure 8 Maintenance strategies based on EN 13306 (2009) (source: Lind & Muyingo, 2011)

By understanding the concept of maintenance given above, maintenance departments are expected to choose the best maintenance strategies for their organisations in order to provide better services and maintain the qualities of the building assets. As defined by EN 13306, a maintenance strategy is “a management method used to achieve the maintenance objectives”. The selection of maintenance strategies can affect the real estate portfolio of the public organisations. For instance, the selection of Planned preventive maintenance or the Responsive maintenance related to the future portfolio strategies of the building assets. The Asset management or the Real estate management can decide the maintenance strategies for building assets because it will have an impact on their business processes. Thus, it is important to in-line the objectives of maintenance departments, the objectives of maintenance strategies, the objective of real estate management, and the objectives of the public organisations in order to coordinate the actions for public building assets. Furthermore, the delivery of maintenance strategies is depending on the type of contracts.

As mentioned in the figure above, the main core of maintenance is Planned maintenance and Responsive maintenance. Therefore, in this research, the focus is on the Planned preventive maintenance and the Responsive maintenance.

From the discussion about maintenance strategies above, it can be concluded that maturity criteria of maintenance strategies will be:

- Maintenance departments are having several options of maintenance strategies.
- Maintenance departments can choose the best strategies suit to their goals.
- The strategies of maintenance departments are in-line with the goals of public organisations.

- Maintenance departments have maintenance policies that support the delivery of maintenance strategies and in-line with the goals of public organisations.
- The ability of maintenance departments to conduct object valuations, that support the decision making of maintenance strategies.
- Maintenance departments perform Planned preventive maintenance and Responsive maintenance.

2.3.6.1 Planning and Process in maintenance

Currently, there is a change of view toward the maintenance strategy from reactive and corrective maintenance to preventive maintenance planning (Straub, 2012). The Planned condition-based maintenance is appropriate for the maintenance of public assets. However, Corrective maintenance is still necessary to response immediate breakdown or failure. The process of Planned preventive maintenance is described in figure 9.

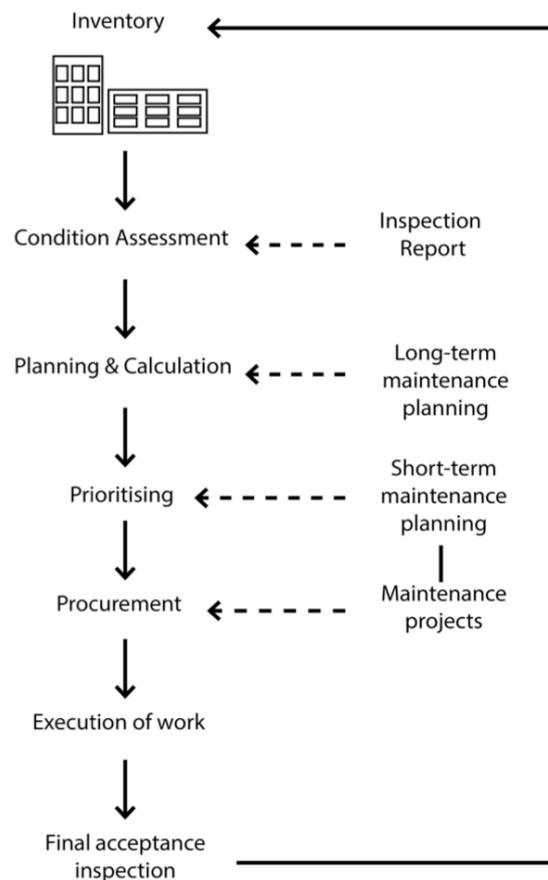


Figure 9. Preventive maintenance, planning and process (Source: Straub, A., Maintenance and Repair, 2012)

The processes of planning the Preventive maintenance is described bellow:

A. Inventory

The first step of Planned condition-based maintenance is assessing the building elements that are necessary to be maintained. The results from inventorying can be used for the next step, which is the condition assessment, where the building elements are being measured to get the data of the defects level.

### *B. Condition Assessment*

The goal of the condition assessment according to Straub A. (2011) is to provide objective information about the technical quality of the building condition, based on its defects. The condition assessment must be objective in order to get the best evaluation of the building assets, and to determine the maintenance strategies. In the Netherlands, there is a condition assessment code that can be applied for building assessment, it is developed by the Netherlands Centre for Standardisation (NEN) in 2010 (Velde, Klatter, & Bakker, 2013). Moreover, the Dutch Government Building Agency has recently provided a six-point scale to measure the building condition, from one, which is excellent to six, which is very bad condition (Straub, 2012). These assessment methods can help the maintenance department and the maintenance personnel plan the strategy and budgeting.

The physical evaluations are assessing the building components, functions, its facilities provided, performances, maintainability, defects, remaining service life, etc. The data from physical evaluation are useful to determine the defects occurred in the building components, and valuing the service standard of building qualities that should be provided. The management then evaluates this data in order to plan with the appropriate maintenance strategies. The characteristics of the building components are then be organised based on the priorities as stated in the NEN 2767, such as critical, serious, or minor defects (Straub, 2011). Moreover, the data are grouped into the degradation process such as low, middle, and high. This building failure conditions are useful for prioritizing the strategies. It is also important to considering the Key Performance Indicator (KPI) and Service Level Agreement (SLA) during the building object assessment (Straub, 2011). This will align the need of the end-users or clients, and the current building conditions.

From the review above, maturity criteria of maintenance departments will be:

- Maintenance departments are able to perform the objective condition assessments.
- Maintenance departments use standards for its condition assessments, for instances the NEN standards.
- Maintenance departments perceive the technical aspects of building components to support the condition assessments.

### *C. Planning and Calculation*

The data derived from the condition assessment are valuable to make plans and calculation. Those data can provide the performance loss, the financial resources, and the appropriate maintenance strategies to achieve the expected quality of maintenance (Straub, 2012).

From this point, according to Straub (2012) the process that is started from condition assessment, planning and calculation are principal for the long-term maintenance planning and procurement of the maintenance activities.

According to Lind and Hellström (2006) and Lind and Lundström (2010) as cited by (Lind & Muyingo, 2011), the maintenance planning is preferably determined several aspects below:

- A good information system will provide better prediction for planning.
- Dividing building into the main building for preventive maintenance, while for the non-main building for corrective maintenance.
- Divide the elemental/components of the building so that the maintenance can be executed based on its decisive need. For example wall, ceiling, and HVAC, those need different maintenance actions.
- Planning on different time-span for different elements of buildings. For example, 20 years of plan, or yearly plan. This can determine when will the main renovation are needed.

- Using technology to input information and data from building users. Thus, the information can provide updated building conditions.

The maintenance departments can incorporate the maintenance costs into the TCO/LCC strategy of their budget calculation. The TCO (Total Cost of Ownership) is an analysis tool to discover the overall of lifetime costs that follow from owning a certain building assets (Schmidt, 2014). Maintenance costs are one of the TCO components. By reducing the maintenance costs through choosing the best maintenance strategies, public organisations can lower their TCO. The variables incorporate in maintenance costs are the maintenance warranty costs, maintenance labours, contracted maintenance services, etc. (Schmidt, 2014). Yet, the public organisation's structure has played an important role to adopt the TCO/LCC calculation. The Asset management or the Real estate management mostly does this calculation method. Again, it depends on who will make the decision towards the TCO/LCC application, whether it will be the maintenance departments or the asset managements.

From the discussion above, the criteria of mature maintenance departments are:

- Maintenance departments are able to do a plan and calculations before delivering maintenance strategies.
- Maintenance departments incorporating the TCO/LCC in their planning, and in-line it with the decisions of public organisations.

#### *D. Prioritising*

After the planning and calculation, the next step is to prioritise the appropriate maintenance strategies, procurement methods, and the results of the maintenance activities that are expected. The priority of maintenance activities is based on the expected results of the building performances. This forecasted results are then aligned with the financial calculation, and procurement methods. Therefore, organisation can choose the best plan, procurement, and agreement for their maintenance activities.

The short-term plan guides the maintenance projects that have to be delivered for the upcoming year (Straub, 2012). Nevertheless, the procurement can be derived from the types of maintenance activities that will be performed.

#### *E. Procurement and contract*

The maintenance departments must decide whether the maintenance should be executed by in-house contractors or outsources. The selection of preferred maintenance suppliers is then done by procurement. As the maintenance departments are part of the public organisations, the procurement types and the contractual types should follow the rules and legislations.

The procurement law in the Netherlands is following the European public procurement law. The procurement of public works has several thresholds. Moreover, there are distinction between the public works and public services. It is stated by Straub (2012) that the term of 'services' in maintenance activities include regular planned maintenance, void repairs, and responsive maintenance. Meanwhile the 'works' incorporate refurbishment and major maintenance.

According to Vijverberg (2005) as cited in (Mossel, 2008), the maintenance contracts that commonly used in the Netherlands are:

- Contracts for breakdown maintenance: it is often used for reactive maintenance.
- All-in contracts: the combine contracts for preventive (planned) maintenance and breakdown maintenance.

Straub (2011) describes about the two types of contract:

- Traditional contract:  
The tender for maintenance projects based on competition and descriptive-based in order to gain the lowest price or best price-quality ration by means of competition.
- Performance-based partnering contract:  
The client explicitly states the performance criteria. The performance-based specifications are based on the performance requirements, Key Performance Indicators (KPI) and Service Level Agreement (SLA). Moreover, this type of contractual relationships focuses on the long-term maintenance scenarios, applying whole life costing. The contractors act as engineer and consultant.

From the review above, we can conclude that the maturity criteria of maintenance departments will be:

- Maintenance departments are able to follow the procurement procedures.
- Maintenance departments are able to perform procurement processes according to the regulations.
- Maintenance departments can decide the appropriate contractual model.

#### *F. Execution of work*

To get better results of maintenance work, it is necessary to understand the suppliers of the maintenance activities. The maintenance department should monitor the performances of the suppliers. Moreover, the maintenance market is fragmented, which means that the activities of different building components and the HVAC have different contractors. Maintenance market, according to the Dutch Economic Institute for the Construction Industry (EIB) are divided into different groups (Mossel, 2008), of which the main groups are:

- Installation maintenance: It covers the works of plumbing, central heating and AC, electrical and mechanical installations.
- Finishing maintenance:
  - First category: Paintwork, glass repair, and wall finishing
  - Second category: plastering, wall insulations.
  - Third category: activities involving hard material such as stones, ceramic tiles and terrazzo.
- Structural maintenance: general maintenance of the building structures.

To cope with those maintenance markets, the maintenance departments can use specific contracts for different tasks. The quality of the supplier's services can be derived from the instruments such as certifications, quality control, etc.

From the discussion above, the criteria of mature maintenance departments are:

- Maintenance departments are able to select appropriate suppliers
- Maintenance departments are able to control the outcome quality of maintenance through supervising.

#### *G. Final Acceptance Inspection*

As the final step of the maintenance process, the final inspection aims to check the quality of the maintenance jobs. This also can determine whether the supplier's performance is fulfilling the requirements of the maintenance departments. Moreover, the results of maintenance projects and its contractual agreement should be matched.

The process of Planned condition-based maintenance then will repeat again to the first step of inventorying building elements. Furthermore, the new data will be stored in the building data.

### 2.3.6.2 Responsive maintenance

The Responsive maintenance can also be called reactive maintenance (Straub, 2010). This type of maintenance is referring to a daily maintenance that in practice directly involves end-customers. The end-customers or facility managers request repairs and appointments for immediate failures or break down. The process of responsive maintenance in public organisation is explained in the figure below.

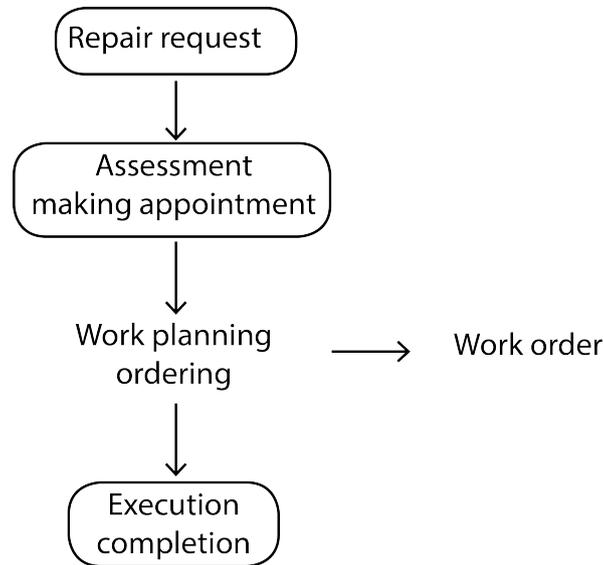


Figure 10 Responsive maintenance (source: Straub, 2011)

When end-customers face the breakdown or failure of building components, a repair requests are made to the maintenance department. The work planning ordering is made, which is called work order. In Corrective maintenance, the condition assessment is also performed. Then the maintenance work is executed. The maintenance department that tackles this process can also be part of the organisation or in-house maintenance department.

In order to reach efficiency of the maintenance costs and process, an integrated contract, which is a framework contract arrangement with suppliers within a long-time period, is often suitable for responsive maintenance.

### 2.3.7 Suppliers performances

To deliver good results of maintenance services, the maintenance departments should reveal the suppliers' capabilities. This is in-line with the view of modern maintenance departments about the importance of continuous improvement of the maintenance personnel. According to Straub (2010), contractors should have knowledge about the whole life costing, building components performances, and servicing the end-customers. Moreover, it is also crucial to provide significant training and knowledge gain for employees in order to achieve development of services (Bamber, Sharp, & Hides, 2002).

According to Pasuraman et al. (1985) as cited by (Lai & Pang, 2010), there are five dimensions of service organisations:

- a. Tangible dimension: This is related to the resources, equipment and facilities; such as provide sufficient man power and sufficiency of replacement components.
- b. Reliability dimension: This is the ability of contractor personnel to perform within the client's standard, for instances in providing services at the time they intended to work.

- c. Responsiveness dimension: This is the willingness of the contractors in delivering services to the internal customers of the building. The example of the action is setting up an appointment quickly.
- d. Assurance: This is the knowledge and courtesy of the contractors to carry out the works, and able to maintain trust and confidence to different stakeholders, for example corporate with clients.
- e. Empathy: This is related to understanding, and sharing feeling to the clients and end-users, such as tidying up the area after repair works.

In order to gather the information on the services outcome and the organisational capabilities, assessment is needed. There are three different levels of assessment for organisation (Bamber, Sharp, & Castka, 2004):

- Third party: There is an independent organisation who assesses the organisation
- Second party: A dependent body that is still related to the organisation conduct the assessment
- First party: the organisation or body assesses themselves

The assessment of an organisation can show the conformance to a specific benchmark, reveal opportunities for improvement or actions and show commitment to a professional approach to management (Bamber, Sharp, & Castka, 2004). In the case of social housing, tenants as end users argue that the most important aspects of maintenance are the quality of the result of maintenance, the competence of maintenance workers, and completing maintenance activities in a single visit (Mossel, 2008). In providing services it does not only depend on the technological capabilities, but also human and organisational capabilities are similarly important (Straub, 2010). The capabilities of the organisation and maintenance personnel will have an impact for the physical outcome of the maintenance projects and for the client satisfaction. In conclusion, an assessment is valuable to control the performance of organisation's professionalism in delivering maintenance services.

From the review above, the criteria of the mature maintenance departments are:

- Maintenance departments are able to supervise the supplier's performances during the maintenance processes.
- Maintenance departments set the maintenance goals for suppliers.
- Maintenance departments can work together with suppliers to reach satisfying results of maintenance.

### 2.3.8 Innovation

Innovation in maintenance departments is imperative in order to enhance their capabilities and qualities of services. The current innovation relates to service qualities, thus the new concept of the service outcome that is initiated by the suppliers (Straub, 2011). The clients and suppliers are cooperating to produce their outcome. This approach is quite new compare with traditional tender.

Another possible innovation is the use of IT to augment the organisations performances. However, to use the IT, it needs knowledge and understanding by the maintenance departments' employees. Moreover, the more updated software, does not guaranty that the works will perform better. It is significant to decide the technology, in which it can improve the organisations performances, not because following the upcoming trend. Nevertheless, the spirit to innovate should be possessed by all of the personnel in the maintenance department in order to encourage the maintenance departments providing the best capability in delivering maintenance services. The culture to promote innovation in the organisation should arrive from the top management level.

The criteria of mature maintenance departments from discussion above are:

- Maintenance departments adopt technology that appropriate to their activities.
- Maintenance departments are always thinking for innovation for better maintenance strategies.
- Maintenance departments encourage their people to always innovate.

## 2.4 Conclusions

We have described in this chapter about the different types of maturity models. For this research, we use the existing maturity models as guidance. According to the thesis topic, we choose the Public Commissioning Maturity Model that measures the professionalism in commissioning the public organisation in the built environment area. We also focus on the Capability Maturity Model, the pioneer of maturity models as a basic model in this research. The researcher expects that these two maturity models will complete the literature reviews to design the final maintenance maturity model.

In this chapter, we also have explained that the EFQM model is a framework model that can assess an organisation to understand their strengths and project their planed results. By using the Enablers of the EFQM model, we can analyse the important factors of maintenance departments.

The focus of the literature on the activities of maintenance departments becomes the biggest part of this literature review. From scientific journals, reports, and books we found that there are many types of maintenance strategies are similar for different area, such as building maintenance, software maintenance, and industrial maintenance. These types of strategies have main important focus, which are Planned preventive maintenance and Responsive maintenance. To narrow down this thesis, this research focuses on those two types of maintenance.

To get more knowledge about the activities of maintenance departments, we also focus on the process of maintenance. By exploring the activities of the maintenance departments, the researcher can achieve general ideas of what are the important elements, the organisation's relationships, and the future innovation.

From the literature reviews above, we also already developed several important criteria of mature maintenance departments. We can conclude those maturity criteria in the table 2 below:

**Table 2 Maturity criteria from literature reviews**

<b>Topics</b>	<b>Maturity aspects</b>
<b>Maintenance objectives and goals</b>	<ul style="list-style-type: none"> <li>• Set clear maintenance objectives and goals.</li> <li>• Translate the objective and goals into actions.</li> </ul>
<b>Roles of maintenance departments</b>	<ul style="list-style-type: none"> <li>• Understand role and responsibilities, and perform it.</li> <li>• Able to perform maintenance planning and controlling.</li> </ul>
<b>Organisations and Stakeholders</b>	<ul style="list-style-type: none"> <li>• Capable in maintain relationships with its stakeholders.</li> <li>• Able to capture client's requirements.</li> <li>• Considering end-users satisfactions.</li> <li>• Capable in selecting appropriate suppliers.</li> <li>• Able to maintain collaboration with all stakeholders.</li> <li>• Incorporating stakeholder's opinions in decision-making.</li> </ul>
<b>Maintenance strategies</b>	<ul style="list-style-type: none"> <li>• Having several options of maintenance strategies.</li> <li>• Able to choose the best strategies suit to their goals.</li> </ul>

	<ul style="list-style-type: none"> <li>• In-line the strategies with the goals of public organisations.</li> <li>• Having maintenance policies that support the delivery of maintenance strategies</li> <li>• Conduct object valuation</li> <li>• Perform Planned preventive maintenance and Responsive maintenance.</li> </ul>
<b>Condition assessment</b>	<ul style="list-style-type: none"> <li>• Perform objective condition assessments.</li> <li>• Use standards for its condition assessments for instances NEN standards.</li> <li>• Perceive the technical aspects of building components</li> </ul>
<b>Planning and Calculation</b>	<ul style="list-style-type: none"> <li>• Able to do planning and calculations.</li> <li>• Incorporating the TCO/LCC.</li> </ul>
<b>Procurement and contracts</b>	<ul style="list-style-type: none"> <li>• Follow the procurement procedures.</li> <li>• Perform procurement processes according to the regulations.</li> <li>• Decide the appropriate contractual model.</li> </ul>
<b>Execution of works</b>	<ul style="list-style-type: none"> <li>• Select appropriate suppliers</li> <li>• Control the outcome quality of maintenance through supervising.</li> </ul>
<b>Suppliers performances</b>	<ul style="list-style-type: none"> <li>• Supervise the supplier's performances during the maintenance processes.</li> <li>• Set the maintenance goals for suppliers.</li> <li>• Collaboration with suppliers</li> </ul>
<b>Innovation</b>	<ul style="list-style-type: none"> <li>• Adopt technology that appropriate for their activities.</li> <li>• Always thinking for new innovation</li> <li>• Encourage their people to always innovate.</li> </ul>

In the next chapter, we will further develop the main maturity aspects of maintenance departments above.

# MATURITY ASPECTS & MATURITY LEVELS

3

## CHAPTER 3

### MATURITY ASPECTS AND MATURITY LEVELS

In chapter 2, we already discussed the role, objectives, tasks, and processes of the maintenance departments. Apart from maintenance departments, we also examined the maturity models and the EFQM model as the assessment methods for measuring organisation's capabilities. In this chapter, the main important factors of maintenance departments from the literature reviews will be incorporated with the EFQM Enablers, from which will develop the proposed maturity aspects and the proposed maturity levels.

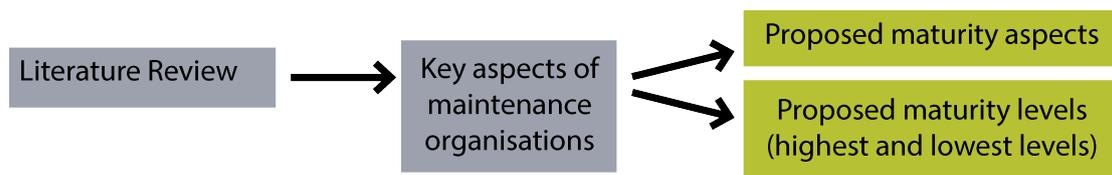


Figure 11 The second research step

#### 3.1 Important aspects of the maintenance departments

To develop the maturity aspects, the first step is to analyse what are the main important aspects of maintenance departments. The literature reviews show the activities of maintenance departments. In chapter 2, we also mentioned the criteria of mature maintenance departments. From the explanation of the literature reviews, we will elaborate more about the focuses of maintenance departments:

##### *a. The objectives and goal of the maintenance departments.*

For an organisation, it is essential to set a goal and objectives at first hand. The reason is by having clear goals and objectives; a maintenance department can then designs the strategies and tools to reach the goals. Furthermore, it is important that a mature maintenance department has a culture that encourages the people to achieve the objectives and goals of the organisation. In executing maintenance, the attitude of the people can improve their ability to provide the best service of maintenance. According to literature reviews of Kans (2008), it can be concluded that the organisation should have a clear organisation's structure in order to provide each organisation's level with appropriate tasks. By having a clear organisational structure, the maintenance department can have a clear process that is understandable for the people in the organisation.

As the results of the first main focus, the criteria of a mature maintenance department are depicted in table 3.

##### *b. The roles of maintenance department*

In chapter 2, we already mentioned that the mature criteria of maintenance departments are understand the role and responsibilities; and able to perform maintenance planning and controlling. Hence, a maintenance department of a public organisation has many roles because of the hierarchical organisation structures, and many stakeholders that are involved. The main roles of maintenance departments is planning and controlling (Haroun & Duffuaa, 2009). The role of controlling is meant to control the outcome and performances of the organisations.

The performances are coming from inside of the organisation such as employees' performances that will affect the results of maintenance services. To control the outcomes means to control the maintenance services. Therefore, it is essential that the maintenance departments can measure their own abilities in delivering maintenance process and services.

According to literature reviews of Hermans, et al. (2014) it can be concluded that understanding the role of maintenance is necessary for a mature maintenance department. Hence, the criteria of a mature maintenance department for this element are explained in table 3.

#### *c. Organisations and Stakeholders*

Public organisations have several stakeholders, which are internal and external stakeholders (Söderholm, Holmgren, & Klefsjö, 2007). In order to cope with the different types and needs of stakeholders, the maintenance departments should develop partnerships and collaboration. The abilities of the maintenance departments to understand the requirements and to satisfy the stakeholders are necessary to be a mature organisation.

As a conclusion, the criteria of a mature maintenance department for this factor are described in table 3.

#### *d. Maintenance strategies*

Maintenance strategies are developed by the maintenance department in order to reach good results of maintenance services. By having clear maintenance strategies, a mature maintenance department can attain their goals. Maintenance strategies are results from the development of maintenance policies. According to the literature studies, there are different types of maintenance strategies such as the Planned preventive maintenance and the Responsive maintenance. The different types of buildings, standards, and regulations can affect the maintenance policy. As consequences, the maintenance strategies can be different for different building assets. It is essential that a mature maintenance department have a maintenance policy to select which types of strategies that have to be applied to buildings and its components, and manage the stakeholders to suit the organisation's strategies. The execution of the maintenance strategies also should be assured by maintenance policies to control the people in the organisation following the procedures.

The criteria of a mature maintenance department for this element are depicted in table 3.

#### *e. Planning and process of maintenance*

Planning and process of the maintenance are the most important part of the maintenance service. A mature maintenance department should have a good maintenance planning and clear processes. The criteria of a mature maintenance department are following the process of delivering maintenance services as discussed in chapter 2. The more important factor, such as the financial part of the TCO/LCC is incorporated in this element because it is related to the maintenance planning.

As the results, the criteria of a mature maintenance department for this aspect are explained in table 3.

#### *f. Maintenance market and suppliers performance*

According to the literature reviews, supplier markets are fragmented. Therefore, it is important that the maintenance departments are able to manage these markets to achieve good maintenance services. It is also necessary that the contractual models are

designed to facilitate the different types of suppliers. Therefore, maintenance departments are able to measure the supplier's performances and capabilities.

In conclusion, the criteria of a mature maintenance department for this factor are depicted in table 3.

#### *g. Innovation*

The last element is to deliberate the innovation factor in the maintenance departments. Innovation can be the new method or model in delivering maintenance processes or a new technology used. This factor is important in a mature maintenance department in order to make the maintenance department keep updated with the change.

It can be concluded from the literature reviews that the criteria of a mature maintenance department for the last element are described in table 3.

According to the conclusions of chapter 2 and the previous discussions, we can summarise the important criteria of a mature maintenance department in table 3. At the left row, we will call the description as the main elements, and at the right row, we will call it as the criteria.

**Table 3 Important aspects of a mature maintenance department based on literature reviews**

	<b>Maintenance management elements</b>	<b>Criteria of a mature maintenance departments</b>
1	Maintenance objectives	<ul style="list-style-type: none"> <li>a. Clear Maintenance objectives</li> <li>b. Good cultures toward maintenance</li> <li>c. Having a clear organisation's structure</li> </ul>
2	Role of maintenance departments	<ul style="list-style-type: none"> <li>a. Understand the organisation roles in planning and controlling</li> <li>b. Understand the maintenance tasks</li> <li>c. Controlling the qualities of maintenance outcomes</li> <li>d. Conduct assessment for internal organisation's performances</li> </ul>
3	Organisations and Stakeholders	<ul style="list-style-type: none"> <li>a. Understand the duties and the role of stakeholders</li> <li>b. Capture the client's requirements and end-users satisfaction</li> <li>c. Maintain the whole process that involving stakeholders</li> <li>d. Maintain partnerships and collaborations</li> </ul>
4	Maintenance strategies (Planned preventive maintenance, Responsive maintenance)	<ul style="list-style-type: none"> <li>a. Having options for maintenance strategies</li> <li>b. Able to select the best strategies</li> <li>c. Having strategies that correlate with output and values of organisations</li> <li>d. Incorporating maintenance policy in organisation's activities</li> </ul>
5	Planning and Process	<p><i>Object valuations:</i></p> <ul style="list-style-type: none"> <li>a. Conduct building's elements inventory</li> <li>b. Delivering objective condition assessment</li> <li>c. Applying standard code for assessment</li> <li>d. Understand components of building assets</li> <li>e. Understand the value of building objects (e.g. financial, technical, functional)</li> </ul>

		<p><i>Organisation's strategies:</i></p> <ul style="list-style-type: none"> <li><b>f.</b> Select appropriate strategies for organisation</li> <li><b>g.</b> Having the desired results of maintenance performances</li> <li><b>h.</b> Having enough skills and knowledge of maintenance process</li> <li><b>i.</b> Incorporate TCO/LCC</li> <li><b>j.</b> Make prioritisation in maintenance planning and services</li> <li><b>k.</b> Having strategies for building management options</li> </ul> <p><i>Procurement and contract:</i></p> <ul style="list-style-type: none"> <li><b>l.</b> Having rule and regulations for procurement and purchasing</li> <li><b>m.</b> Following procurement procedures</li> <li><b>n.</b> Deciding contractual model that appropriate for different maintenance strategies</li> <li><b>o.</b> Having the selection criteria to select appropriate suppliers</li> <li><b>p.</b> Able to conducting procurement professionally</li> <li><b>q.</b> There is collaboration and agreement model</li> <li><b>r.</b> Setting goal for suppliers</li> <li><b>s.</b> Carry out final inspection</li> <li><b>t.</b> There is flexibility in the contracts</li> </ul>
6	Maintenance Market & supplier performances	<ul style="list-style-type: none"> <li><b>a.</b> Managing the fragmented market for multi criteria of maintenance projects</li> <li><b>b.</b> Designing contracts to incorporate the fragmented markets</li> <li><b>c.</b> Measuring supply market performances</li> <li><b>d.</b> Reveal the capabilities of the maintenance suppliers</li> <li><b>e.</b> Assessing the supplier's performances</li> </ul>
7	Innovation	<ul style="list-style-type: none"> <li><b>a.</b> Always innovating and incorporate innovation for organisation's performances</li> <li><b>b.</b> Having mind-set toward innovation for procurement methods</li> <li><b>c.</b> Encourage creativity</li> </ul>

The next step of developing a maturity model is to synthesise the maturity aspects and sub aspects of maintenance departments in table 3 with the enablers of the EFQM model.

### 3.2 Relationships between the EFQM model and key aspects of maintenance departments

The Enablers factors in the EFQM model are then combined with the maturity elements and aspects of maintenance departments of table 3. The results are the proposed maturity model for maintenance department.

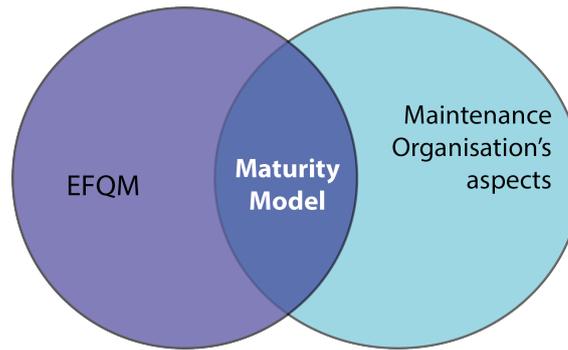


Figure 12 syntheses of the EFQM and maintenance aspects (source: own illustration, 2015)

To make it clear, we will name the left row of table 3 as “elements” and the right row of table 3 as “criteria”. Firstly, we will insert the elements of table 3 into the five enablers of EFQM. This will categorises the content of table 3 according to the EFQM enablers. The result is as follows:

Table 4 Grouping the maturity aspects into the EFQM enablers

The EFQM enablers	Criteria of mature maintenance departments from table 3
1. Processes and Services	(5) Planning and processes (3) Organisations and Stakeholders (6) Maintenance market and suppliers performances (2) Role of maintenance departments
2. Partnership and Resources	(6) Maintenance market and suppliers performances (7) Innovation (3) Organisations and Stakeholders (5) Planning and processes
3. Leadership	(3) Role of maintenance departments (1) Maintenance objective (4) Planning and processes (7) Innovation (4) Maintenance strategies
4. People	(1) Role of maintenance departments (7) Innovation
5. Strategy	(4) Maintenance strategies

From the table 4 above, it can be seen that many maintenance elements can fit into several enablers because they are related. For example, “Planning and process” of table 3 can be grouped into the Enabler of “Processes & Services”, “Partnership & Resources”, and “Leadership”. It is obvious that “Planning and process” is related to the enabler of “Process & Services”. Furthermore, it can be also grouped into “Partnerships and resources” because in table 3 we can see that the activities within it is related to the ability of maintenance departments in managing their resources, strengthen the partnerships, and manage the collaborations. In addition, the enabler of “Leadership” is important as a driver of the organisations in performing the “planning and process” of maintenance.

This example is also applied to other factors in table 3 that one element can be placed into many Enablers. To narrow it down, the EFQM Enablers will act as the main aspects of the proposed maturity model. Moreover, the criteria described in table 3 that

located in the right column, will be placed according to the suitable EFQM Enablers, as maturity sub aspects. The grouping is described in table 5 below:

**Table 5 Grouping the maturity criteria**

	<b>The EFQM enablers</b>	<b>Sub criteria from table 3</b>
1	<b>Processes &amp; Services</b>	2c, 3b, 5a, 5b, 5c, 5d, 5e, 5s, 6e
2	<b>Partnerships &amp; Resources</b>	3d, 5g, 5i, 5k, 5l, 5m, 5n, 5o, 5p, 5q, 5r, 5t, 6a, 6b, 6c, 6d, 7b
3	<b>Leadership</b>	2d, 5h, 5t, 7a, 7b, 7c
4	<b>People</b>	3c, 5j, 5t, 6a, 7a, 7b, 7c
5	<b>Strategy</b>	4a, 4b, 4c, 4d, 5f, 5j, 5k

After categorising the criteria of table 3 into the EFQM enablers, the next step is to describe the criteria into more compact definition. In table 6, we will put the compact definition in the right column, and we will name it as sub aspects. These definitions are the summary of the criteria of table 3 that in table 6 are located in the middle column. In addition, the sub aspects definitions are also influenced by the literature review of the EFQM model assessment sheet (EFQM, 2012), and adopt the sub aspects of the Public Commissioning maturity model (PCMM). The reason is that the assessment sheet of the EFQM model shows what are important aspects that should be considered by the organisations for each enabler. In addition, the sub aspects of the PCMM can fill in the criteria that essential for public sector organisations. The development is as follows:

**Table 6 New definitions of the sub aspects of the proposed Maturity model**

<b>The EFQM enablers</b>	<b>Sub criteria of table 3</b>	<b>New sub aspects definitions in the proposed Maturity model</b>
<b>Processes &amp; Services</b>	5a. Conduct building's elements inventory. 5b. Delivering objective condition assessment. 5c. Applying standard code for assessment. 5d. Understand components of building assets. 5e. Understand the value of building objects (e.g. financial, technical, functional).	<b>a. Performing object valuation</b>
	2c. Controlling the qualities of maintenance outcomes.	<b>b. Supervising maintenance project</b>
	3b. Capture the client's requirements and end-users satisfaction.	<b>c. Responding client's feedback</b>
<b>Partnerships &amp; Resources</b>	5g. Having the desired results of maintenance performances.	<b>a. The use of technology in maintenance process and services</b>

	<p>3d. Maintain partnerships and collaborations. 5q. There is collaboration and agreement model. 6c. Measuring supply market performances.</p>	<b>b. Manage the collaboration with the maintenance market</b>
	<p>5r. Setting goal for suppliers 6d. Reveal the capabilities of the maintenance suppliers.</p>	<b>c. Setting the supplier's goal</b>
	<p>6a. Managing the fragmented market for multi criteria of maintenance projects. 5k. Having strategies for building management options.</p>	<b>d. Manage the resources of the organisation in a sustainable way</b> <i>(This sub aspect is adopted from the EFQM assessment sheet)</i>
	5i. Incorporate TCO/LCC.	<b>e. TCO/LCC</b> <i>(This sub aspect is adopted from the sub aspects of PCMM)</i>
	<p>5l. Having rule and regulations for procurement and purchasing. 5m. Following procurement procedures. 5o. Having the selection criteria to select appropriate suppliers. 5p. Able to conducting procurement professionally. 7b. Having mind-set toward innovation for procurement methods.</p>	<b>f. Procurement process and procedures</b>
	<p>5n. Deciding contractual model that appropriate for different maintenance strategies. 5t. There is flexibility in the contracts. 6b. Designing contracts to incorporate the fragmented markets.</p>	<b>g. Appropriate contractual model</b>
<b>Leadership</b>	7a. Always innovating and incorporate innovation for organisation's	<b>a. Continuously improving</b> <i>(This sub aspect is adopted from the sub aspects of</i>

	performances.	<i>PCMM)</i>
		<b>b.</b> Encourage integrity, transparency, effectiveness, and legality rules. <i>(This sub aspect is adopted from the sub aspects of PCMM)</i>
	5t. There is flexibility in the contracts. 7b. Having mind-set toward innovation for procurement methods.	<b>c.</b> Manage the change and flexibility
	7a. Always innovating and incorporate innovation for organisation's performances. 5h. Having enough skills and knowledge of maintenance process.	<b>d.</b> Set the mission and vision of the organisation, and incorporate the people of the organisation in doing it <i>(This sub aspect is adopted from the EFQM assessment sheet)</i>
	2d. Conduct assessment for internal organisation's performances. 5h. Having enough skills and knowledge of maintenance process. 7c. Encourage creativity.	<b>e.</b> Developing human resources
<b>People</b>	5t. There is flexibility in the contracts. 7a. Always innovating and incorporate innovation for organisation's performances. 7b. Having mind-set toward innovation for procurement methods. 7c. Encourage creativity.	<b>a.</b> Innovation and creativity <i>(This sub aspect is adopted from the sub aspects of PCMM)</i>
	5j. Make prioritisation in maintenance planning and services.	<b>b.</b> Control in organisation
	3c. Maintain the whole process that involving stakeholders. 6a. Managing the fragmented market for multi criteria of maintenance projects.	<b>c.</b> Managing stakeholders <i>(This sub aspect is adopted from the sub aspects of PCMM)</i>

<b>Strategy</b>	4a. Having options for maintenance strategies. 4b. Able to select the best strategies. 4c. Having strategies that correlate with output and values of organisations.. 4d. Incorporating maintenance policy in organisation's activities.	a. Maintenance policy
	5f. Select appropriate strategies for organisation. 5j. Make prioritisation in maintenance planning and services. 5k. Having strategies for building management options.	b. Maintenance strategy (planned preventive maintenance or responsive maintenance)

### 3.3 The proposed maturity aspects and maturity levels

The final results of the syntheses of the EFQM model, and the maturity criteria of maintenance department are described in the following table 7. The contents of table 7 are the proposed maturity model.

In table 7, there are five Enablers as main aspects that in each have sub aspects. These sub aspects are outcomes from table 6 that describing the factors of a mature maintenance department. The arrangement of the Enablers is according to the importance of each enabler for maintenance departments of public organisation. Therefore, the first enabler is "Processes and Services", which has three sub aspects.

The first sub aspect is "Performing object valuations" that become the early stage of processes in maintenance, followed by "Supervising maintenance project" and "Responding client's feedback". In maintenance processes, there are other activities such as procurement process. However, procurement aspect is then placed in the second enabler, because procurement is more related to the partnerships and resources of an organisation.

The second enabler of the proposed maturity model is "Partnership and resources". The first aspect here is "The use of technology". The reason to put this first sub aspect under the second enabler is that technology nowadays is supporting all activities in maintenance departments. Technology can be a great resource of an organisation. The second until fourth sub aspects in this enabler are related to the partnerships. The "TCO/LCC" is the fifth sub aspects that related to resource management of an organisation. The sixth and seventh sub aspects are "Procurement process and procedures", and "Appropriate contractual model". These sub aspects are related to partnerships of maintenance departments with its clients, suppliers and stakeholders.

The third enabler is "Leadership" that has five sub aspects. Those five sub aspects related to the quality of leaderships that can bring the organisations into success. In this enabler, some sub aspects are also adopted from the assessment sheet of the EFQM model, and from the PCMM's sub aspects.

The fourth enabler is “People” that has three sub aspects. These three sub aspects related to the capability of the people in the organisation to manage the people inside and people from outside the organisation, such as stakeholders, which are essential for the organisation. In addition, these sub aspects cover the value of people to be more productive and innovative.

The last enabler is “Strategy” that covers the strategy of maintenance departments. This enabler has two sub aspects, “Maintenance policy” and “Maintenance strategy”. The first sub aspect, “Maintenance policy” is placed in this enabler because the existence of maintenance policies can affect the types of maintenance strategies that should be performed. The second sub aspect is “Maintenance Strategy” that in this research specifically focuses on Planned Preventive Maintenance and Responsive Maintenance strategies.

The final results of the synthesis between the EFQM enablers, and the important criteria of maintenance departments are the proposed maturity model, as shown in table 7 below:

**Table 7 Proposed Maturity aspects**

<b>Proposed Maturity Aspects</b>	
<b>The EFQM enablers</b>	<b>Sub aspects</b>
1. <b>Processes &amp; Services</b>	<ul style="list-style-type: none"> <li>a. Performing object valuation</li> <li>b. Supervising maintenance project</li> <li>c. Responding client’s feedback</li> </ul>
2. <b>Partnerships &amp; Resources</b>	<ul style="list-style-type: none"> <li>a. The use of technology in maintenance process and services</li> <li>b. Manage the collaboration with the maintenance market</li> <li>c. Setting the supplier’s goal</li> <li>d. Manage the resources of the organisation in a sustainable way</li> <li>e. TCO/LCC</li> <li>f. Procurement process and procedures</li> <li>g. Appropriate contractual model</li> </ul>
3. <b>Leadership</b>	<ul style="list-style-type: none"> <li>a. Continuously improving</li> <li>b. Encourage integrity, transparency, effectiveness, and legality rules.</li> <li>d. Manage the change and flexibility</li> <li>e. Set the mission and vision of the organisation, and incorporate the people of the organisation in doing it</li> <li>f. Developing human resources</li> </ul>
4. <b>People</b>	<ul style="list-style-type: none"> <li>a. Innovation and creativity</li> <li>b. Control in organisation</li> <li>c. Managing stakeholders</li> </ul>
5. <b>Strategy</b>	<ul style="list-style-type: none"> <li>a. Maintenance policy</li> <li>b. Maintenance strategy (planned preventive maintenance or responsive maintenance)</li> </ul>

### *The proposed maturity levels*

After having the proposed maturity aspects, the researcher breaks each sub aspect down into maturity levels. The proposed maturity levels are based on the highest level of the maturity model, which is level 5, and the lowest level, which is level 1. The idea of defining the highest and the lowest is because it is more comprehensive for the organisations to know the highest expectation can be as a maintenance department and the lowest possible condition. Furthermore, it can also make the researcher able set the benchmark to develop the criteria of each level. In addition, this will make the interview respondents easy to grasp the maturity levels and provide their feedbacks. The gap between the highest and the lowest level are the levels two to four.

The highest level of the proposed maturity levels is the results of the maturity criteria as discussed in the table 3, and from the literature review of the CMM (Capability Maturity Model). The proposed maturity levels are described in the table 8 below:

**Table 8 The Proposed maturity levels**

PROPOSED MATURITY MODEL		
THE EFQM ASPECTS	SUB ASPECTS	MATURITY LEVELS DEFINITION
<b>1 Processes &amp; Services</b>	Performing object valuation	<p><b>Highest level (Level 5 - Optimized):</b> The organisation performing objects valuation as a first step of planning maintenance. This step allows organisations to assess the critical level of maintenance needed for the building objects.</p> <p><b>Lowest level (Level 1 – Initial):</b> The organisation does not perform object valuation. The maintenance works are carried based on estimation.</p>
	Supervising maintenance activities	<p><b>Highest level (Level 5 - Optimized):</b> The organisation supervises the maintenance projects and make sure the results is satisfying the client's goals.</p> <p><b>Lowest level (Level 1 – Initial):</b> The organisation does not supervise the maintenance activities, or the work supervising is still chaotic.</p>
	Responding client's feedback	<p><b>Highest level (Level 5 - Optimized):</b> The organisation already has a system to cope with the feedback from the clients. All of the feedback is responded well.</p> <p><b>Lowest level (Level 1 – Initial):</b> The organisation does not have any system to cope with the client's feedback. The responses from clients are handled without good follow up.</p>
<b>2 Partnership &amp; Resources</b>	Applying technology	<p><b>Highest level (Level 5 - Optimized):</b> The organisation maximising the potential of technology for the activities in their organisation that can increase their productivities and process development.</p>

	<p><b>Lowest level</b> (Level 1 – Initial): The organisation is not applying technology for their process and productivities. The technology used is standard types for the office works.</p>
Manage the collaboration with the maintenance market	<p><b>Highest level</b> (Level 5 - Optimized): The organisation builds partnership with suppliers and clients based on mutual trust, respect and openness, to make sure that the process and works are in line with the organisation’s strategies and values.</p>
Setting the supplier’s goal	<p><b>Lowest level</b> (Level 1 – Initial): The organisation does not build relationships with suppliers and clients.</p> <p><b>Highest level</b> (Level 5 - Optimized): The organisation sets the supplier’s goals that align with the client’s expectation to make the results of the maintenance activities clear and achieve the best results.</p> <p><b>Lowest level</b> (Level 1 – Initial): The organisation does not set the supplier’s goals; the outcome of the maintenance projects can be different to the client’s goals.</p>
Manage the resources of the organisation in a sustainable way	<p><b>Highest level</b> (Level 5 - Optimized): The organisation can manage their assets very well and organised. Organisation concern about the sustainability of their resources.</p> <p><b>Lowest level</b> (Level 1 – Initial): The organisation cannot manage their assets and does not incorporate sustainability in the management.</p>
TCO/LCC	<p><b>Highest level</b> (Level 5 - Optimized): The organisation incorporating TCO/LCC in their accounting/ financial report.</p> <p><b>Lowest level</b> (Level 1 – Initial): The organisation does not implement or consider toward TCO/LCC in their financial/ accounting.</p>
Procurement process and procedures	<p><b>Highest level</b> (Level 5 - Optimized): The organisations following the process and regulation by the policy maker toward maintenance procedures and process for public organisation.</p>

		<p><b>Lowest level</b> (Level 1 – Initial): The organisation does not have and follow a procurement standard.</p>
	Appropriate contractual model	<p><b>Highest level</b> (Level 5 - Optimized): The organisation sets contractual model for different maintenance strategies such as planned preventive maintenance and responsive maintenance.</p> <p><b>Lowest level</b> (Level 1 – Initial): The organisation does not set a contractual model for different maintenance strategies.</p>
<b>3 Leadership</b>	Continuously improving	<p><b>Highest level</b> (Level 5 - Optimized): Leader design, monitor, review and drive the enhancement of the organisation’s management system and performance. This will make sure that the organisation is continuously improving.</p> <p><b>Lowest level</b> (Level 1 – Initial): Leader of the organisation does not have any plan to improve organisation capabilities.</p>
	Encourage integrity, transparency, effectiveness, and legality rules	<p><b>Highest level</b> (Level 5 - Optimized): Transparent organisation; people are having integrity; legality rules are set clearly; encourage effectiveness in the organisation. The leader can incorporate all of the aspects needed for the organisation’s development.</p> <p><b>Lowest level</b> (Level 1 – Initial): The management of the organisation is not transparent. There is no encouragement for integrity. There are no clear legality rules. The organisation does not encourage the effectiveness of working.</p>
	Manage the change & flexibility	<p><b>Highest level</b> (Level 5 - Optimized): Effective to manage the change through focus on improvement and flexibility, which is, able to make decisions in an organisation based on available information that focus on process enhancement.</p> <p><b>Lowest level</b> (Level 1 – Initial): The organisation is not ready for the changing and do not have any instrument to cope with the new development.</p>
	Set the mission and vision of the organisation, and incorporate the	<p><b>Highest level</b> (Level 5 - Optimized): Organisations have clear vision and mission, and have strategies to achieve it. The leader develops the goals of the organisation and make sure that the goal is</p>

	people of the organisation in doing it	achieved. <b>Lowest level</b> (Level 1 – Initial): There is no organisation's vision and mission, or the vision and mission are not clear. There are no strategies to achieve the organisation's goal.
	Developing human resources	<b>Highest level</b> (Level 5 - Optimized): Skills and competence of the people in the organisation are recognised and developed.  <b>Lowest level</b> (Level 1 – Initial): The people are not encouraged for improving their competencies.
<b>4 People</b>	Innovation & creativity	<b>Highest level</b> (Level 5 - Optimized): The organisation recognise that innovation can apply to process in the organisation. Creativity is encouraged as a part of the culture in the organisation.  <b>Lowest level</b> (Level 1 – Initial): The organisation does not promote innovation in the organisation. Creativity is not assembled in the organisation's culture.
	Control in organisation	<b>Highest level</b> (Level 5 - Optimized): The organisation recognised the people skills and competence. Their supports and effectiveness for organisation are awarded. Their activities are monitored to make sure that they are cared and increase their productivity.  <b>Lowest level</b> (Level 1 – Initial): The organisation does not monitor the people's activities. There is no reward system.
	Managing stakeholders	<b>Highest level</b> (Level 5 - Optimized): The organisation is ensured that stakeholders are treated well in order to achieve their common goals. An organisation can understand their position between the stakeholders. An organisation can understand the aim of the stakeholders and try to satisfy the stakeholders.  <b>Lowest level</b> (Level 1 – Initial): The organisation ignores the important of managing their relationship with the stakeholders.
<b>5 Strategy</b>	Maintenance policy	<b>Highest level</b> (Level 5 - Optimized): The organisation has a maintenance policy that can be followed when performing maintenance activities.

	<b>Lowest level</b> (Level 1 – Initial): The organisation does not have maintenance policy.
Maintenance strategy (Planned Preventive maintenance and Responsive maintenance)	<b>Highest level</b> (Level 5 - Optimized): The organisation can perform professionally the strategy of planned preventive maintenance and responsive maintenance.
	<b>Lowest level</b> (Level 1 – Initial): The organisation does not have maintenance strategies of planned preventive maintenance and responsive maintenance.

The proposed maturity aspects and the proposed maturity levels will be verified through expert's interviews. Furthermore, to develop the second level to the fourth level, the professional feedbacks can be added in the level definitions. Hence, we must understand what are the criteria of the maturity levels two to four. In table 9, we can see the definition of level two, three, and four criteria based on the CMM by Paulk et.al (1993) that will be the main guideline for the level development after the first round interviews. The results of the interviews will be explained in chapter 4.

Table 9 Proposed maturity levels 2, 3 and 4 (source: Paulk et.al, 1993)

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**Level 2 REPEATABLE**

***Policy is established to guide the processes***

**Level 3 DEFINED**

***Consistent and standardised***

**Level 4 MANAGED**

***Processes are well defined and goals are set***

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### 3.4 Conclusions

This chapter explains the step by step development of the proposed maturity model as a base to carry on expert interviews. The literature reviews in chapter 2 has produced maturity elements of maintenance departments. From these key elements, the maturity criteria are then merged with the EFQM model enablers. From here, the maturity levels are developed through placing the highest possible level, and the lowest possible level. The interview method, then confirms if these levels are appropriate, and what are the improvements needed.

# THE INTERVIEW FINDINGS

# 4

## CHAPTER 4

### THE INTERVIEW FINDINGS

This chapter describes the processes and results of the interviews. The proposed maturity aspects and the proposed maturity levels should be clarified whether it is relevant to be included in the maturity model. Furthermore, these interviews will gather the opinions from respondents. In addition, their knowledge can contribute to the development of a better maturity model.

The interview questions are designed to improve the proposed maturity model. Therefore, semi-structured interviews were conducted to guide the respondents in answering the questions clearly. The interview protocol can be seen in [APPENDIX I](#). The following sections will explain the results and analyses of the interviews.

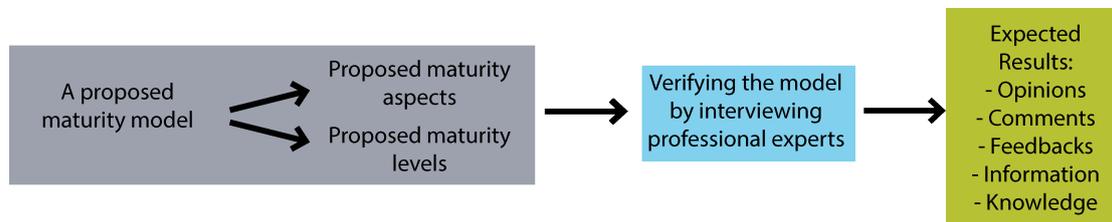


Figure 13 The third research step

#### 4.1 Interview respondents

The selection of interview respondents is important. The experts should have the knowledge about management of the maintenance department in public organisation areas. Respondents for this research are varied. They are working in public sectors and private sectors. For the respondents from private organisations, they have experiences working together with public organisations, or involved in public projects. The respondents who work within public organisations can share their knowledge from an inside perspective, and the respondents of private organisations can give their opinions from outside perspective. Thus, respondents view can enrich the knowledge, contents, and perspectives of the maturity model in this research to be more relevant. The interview transcripts are provided in [APPENDIX III](#).

We have 9 respondents in total for the interviews. The interview is divided into two rounds. For the first round, there are 6 respondents, and the second round has 3 respondents. The purpose of the first round interviews is to check the proposed maturity model, whether those aspects are valid. Furthermore, the first interviews also ask the respondent's opinions and possible improvements for those maturity aspects, maturity sub aspects, and maturity levels. The second round interviews aim to check the assessment sheet, whether it is useful as an assessment tool to reveal the maturity of maintenance departments. The discussion of second round interviews will be described in chapter 6.

In this thesis report, the respondents will be given with the code of [Respondent X]. X represents an alphabet that will be different for each respondent. The purpose is for the reader's neutrality, and not to associate the respondents with the organisations where they are work in. Some of the second round interview respondents also giving feedbacks toward the maturity sub aspects. Therefore, it will incorporate in this chapter as well. The interview respondents of this research:

### *1. Gemeente Delft (the municipality of Delft)*

The respondent from the municipality of Delft is working in the real estate department. This real estate department has three divisions; those are property management, technical management and administration. The maintenance task is under the technical management. The municipality of Delft is managing around 300 building objects such as monumental buildings, offices, etc. The real estate department also leases their properties, and manage their relationships with the owner and the users of the buildings.

### *2. Gemeente Rotterdam (the municipality of Rotterdam)*

The respondent from municipality Rotterdam is the project manager of the real estate department. He is a contract manager that responsible for managing 9 swimming pools and its energy services. The client of the real estate department is the Department of culture and sport.

### *3. FMVG TU Delft (The real estate department of TU Delft)*

The respondent from the real estate department of the TU Delft is a maintenance engineer. The real estate department of the TU Delft is responsible for managing the maintenance services of all campus buildings in TU Delft. He is also involved in the new building project in TU Delft that incorporates maintenance in its plan.

### *4. FMVG TU Eindhoven (The real estate department of TU Eindhoven)*

The interviewee from TU Eindhoven is the head department of real estate and maintenance. He is responsible for managing the campus buildings.

### *5. Strukton (Supplier company)*

The interviewee from Strukton is the commercial manager in one of the company's unit that is responsible for building installation maintenance. Strukton is a construction company in the Netherlands that focus on transportation systems, civil infrastructure, and building engineering (Strukton, 2012). The company has been operating for 47 years and currently has approximately 6000 employees. The customers of Strukton are including universities, hospitals and private companies.

### *6. Kloet Onderhoud (Supplier Company)*

This company is a medium sized family owned company. This company has speciality on real estate maintenance, and interior decoration. The interview respondent from Kloet Onderhoud is the general manager. He is responsible for the company's strategies, external relationships and the organisation structures. This company has clients from housing associations, investors, hotel, real estate owners, and public organisations.

### *7. CBRE Amsterdam (Real Estate Company)*

The respondent from CBRE has a position as technical manager. The technical manager position is under the property management that responsible for the physical maintenance such as paintwork, cooling systems, and roofing. The goal of this company is to satisfy tenants.

### *8. Tiberius Maintenance (Maintenance Consulting Company)*

The expert from this company provides consultancy for public organisations and higher institutions. The aim of this company is to make sure that the collaboration between the maintenance departments with its clients, suppliers, and stakeholders are manageable and the processes of maintenance are good.

### 9. ISSO (Building installation research institute in the Netherlands)

The respondent from this company is the head of the department. This company publishes standards for maintenance and installations that can be used as guidelines by public and private organisations.

## 4.2 Important aspects of Maintenance departments

During the interviews, respondents were asked in an open question about their opinions about the main important things in the maintenance department. Some important remarks are not yet covered in the proposed maturity aspects. The results of the interviews are then compared to get a better overview of the similarities and differences between the respondent's opinions. The comparison will also reveal which maintenance factors that are more important than the others. The comparison table is provided with [APPENDIX II](#).

In general, the EFQM enablers are relevant for maintenance department in the public organisation. According to the interview respondents, there are important aspects of the maintenance departments, those factors are:

1. *People in the organisation.*

This factor is the most important elements in maintenance department that can drive the quality of services for clients and users. The people in the organisation should have adequate skills and knowledge about how to deliver maintenance services and maintain relationships with the stakeholders [Respondent A] [Respondent D]. Moreover, people should have the EQ ability and not only the IQ in order to be competent in handling communication and partnerships [Respondent E].

2. *The services and product of the people*

To make sure that all of the people in the organisation can deliver the best quality of maintenance services is important [Respondent A].

3. *Integral quality*

It is more valuable to think about maintenance as an integral process. This is why the Planned preventive maintenance and the Responsive maintenance cannot be separated [Respondent C]. The maintenance department can describe the integral quality as the maintenance output that must be delivered by the suppliers [Respondent E].

4. *Change optimisation*

The concept of change optimisation is to shift the focus, from the relationship between maintenance departments and suppliers, into maintenance departments and users [Respondent C]. By changing the focus, the maintenance department can understand the performances desired by the clients and users.

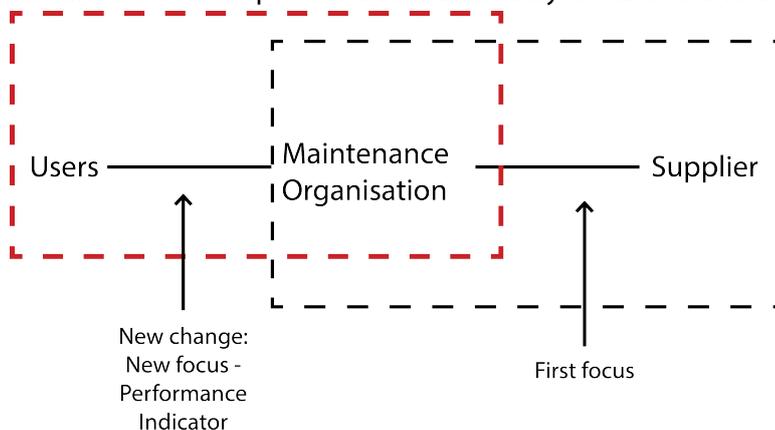


Figure 14 the concept of change optimisation (source: interview [Respondent C], interview transcript, 2015)

#### 5. *Relationship and collaboration*

It is important to maintain relationships with the suppliers, clients and users. For government organisations, it is also important to have a good relationship with the politician. By having good relationships, the maintenance department can get a feedback from clients, information toward new technology and information from suppliers that can develop higher standards for maintenance quality and performances. The collaborations should be stated clearly in the contract so that each party can responsible for performing their services [Respondent B]; [Respondent A]; [Respondent C]. In the future, the development of collaboration is about working together between the maintenance departments and its stakeholders, and between different suppliers, in order to achieve the maintenance goals [Respondent E].

#### 6. *Control in organisation*

According to [Respondent F] control in the organisation is important, but it is better to have more social controls than rational controls. In rational control, the quality of services is controlled according to rules and procedures. But this can lead to opportunistic behaviour. In social control, there will be less cost, but the tendency of fraud is higher. Therefore, it is better to manage the control in the organisation between rational and social control. For instance, in supervising maintenance, it is not necessary to check all of the projects, but it is better to have sample supervisions [Respondent F]. By giving trusts to the suppliers, it will increase their responsibilities in delivering maintenance services.

#### 7. *Organisation structure*

During the interview, the organisation's structure can define the scope of the maturity levels. According to [Respondent H], the structure organisation of maintenance departments is commonly under the Real estate management or the Asset management. The maintenance department is working with suppliers and usually become part of the facility management. It has to be clear of which maintenance departments that the maturity model aims for.

### 4.3 The EFQM enablers

All of the respondents recognised the EFQM enablers very well and have different opinions about it. Some respondents stated that all of the enablers are important. However, the others made rank on which enablers are the most important factor for maintenance department. According to [Respondent F] it is important to follow the flow of the EFQM model. Therefore, the first important enabler is the Leadership, then followed by Strategy. The next important enablers are "People" and "Partnerships and resources". The least important is processes and services. That opinion is different when compared to most of the respondents, whereas the top EFQM enablers for maintenance department are "People" and "Processes & Services".

In this research, the proposed maturity model is started with the enabler of "Processes and Services". While the interview respondents have different opinions towards the first important enabler, we think that for maintenance departments, it is essential that the organisations have mature conditions for its "Processes and services", because that is the main important value that should be delivered to the clients and stakeholders. People will see the professionalism of an organisation from its services. Therefore, for this research the enablers in the maturity model will start first with "Processes and Services". Thus, it will be followed by "Partnerships & resources", "Leadership", "People", and "Strategy". The configuration is based on the rank of importance.

The results of interviews for each enabler and their sub aspects will be described as follows:

### 4.3.1 Processes & Services enablers

The processes and Services enabler is one of the most important factors in the maintenance department according to the interview respondents. According to [Respondent A], this factor is important because the services output of maintenance department will show the quality of the management in the organisation. By having good services, the maintenance departments are also satisfying clients and users. The quality of process in tendering is important for public organisation [Respondent B]. Furthermore, it is important that the maintenance department and suppliers have the same system in order to synchronise the data and improve communication [Respondent E]. These enablers are relevant as one aspect of maturity model for maintenance department.

According to the proposed maturity model, the sub aspects are:

#### *a. Performing object valuation*

Performing object valuation is the first step before performing maintenance. The value of the building object can be of financial value, technical value, functional value, etc. The standard of doing the condition assessment in the Netherlands is the NEN in which building is assessed using 6 scales. The [Respondent B] stated that object valuation is important to make an agreement with the suppliers, related to the condition level standard of the building asset. By keeping the building condition level as stated in the contracts, it will reduce the failures that can happen in the future. Moreover, it is important to write down in the contracts how the suppliers should perform that will result in desired scales of building condition. On the other hand, [Respondent D] explained that using the NEN as a tool for performing object valuation is not useful for making an agreement with the partner, but will be useful on financial value. Thus, for instance, if the building scale is about 1-2, which is meant the condition is good, then the financial value is good. The respondents imply that there is no difference between Planned preventive maintenance and Responsive maintenance in performing object valuation, because in the contract, the failures that happen to the contract for long-term agreement are a responsibility of the supplier. Therefore, maintenance department only controls the entire building condition at the scheduled time [Respondent B].

In the other hand, from the perspective of supplier, performing object valuation is essential to plan what types of strategies that must performed [Respondent E]. The types of strategies can be the Planned preventive maintenance or the Responsive maintenance. Thus, there should be diversification in planning the maintenance strategies. The importance of object valuation is to link the purpose with the organisational objectives [Respondent F].

In general, "performing objects valuation" is a relevant sub aspect of the maintenance departments. By performing object valuation, an organisation can set the future strategy for the building assets.

#### *b. Supervising maintenance activities*

This sub aspect is important for maintenance department. According to [Respondent B], supervising buildings is important to check the condition of the buildings between 1-3 on the NEN scale. Supervising maintenance also has to do with supervising contracts and supervising projects [Respondent D]. Moreover, supervising can be useful to check the schedule and budget. These activities should contribute to the user's satisfaction [Respondent G]. The budget spent for maintenance activities should balance with the quality achieved [Respondent D]. In the future, the role of supervising maintenance should become the task of suppliers in order to add value for suppliers [Respondent E]. However, the maintenance departments should build trust with the suppliers [Respondent F]. The activity such as performing sample supervision is preferable to build trust relationships.

According to the interviews, the sub aspect of supervising maintenance activities can be incorporated in the maturity model for maintenance department.

### *c. Responding client's feedback*

The clients' opinions are valuable for a maintenance department to improve the services of the maintenance. In order to get feedback from the clients, the maintenance department can organise regular meetings with the clients and suppliers to understand their needs [Respondent B]. However, it is more important for the maintenance department to make sure that the problem raised by the clients is solved, and not repeated in the future [Respondent C]. Therefore, it is important to evaluate the relationships between the clients and the suppliers as well. As the suppliers are many, they should be able to work together in order to respond the feedback, and work together to solve the problems [Respondent E].

In the maintenance department, a standard time to respond client's feedback is essential. For instance, in Responsive maintenance, the responses should be between 12 hours – 1 month. This means that in this time interval, the maintenance department should fix the failures of the building object [Respondent B]. By having the response standard, the maintenance department can perform and having competence to provide a better service [Respondent B], [Respondent D].

For the Planned preventive maintenance, responding client's feedback can be useful for future planning, whereas for daily maintenance or responsive maintenance, responding client's feedback is useful in solving the failure problem as soon as possible. Furthermore, the suppliers should be able to give feedbacks for the maintenance department in order to provide insights that can increase their relationships, and maintenance qualities [Respondent F].

### **4.3.2 Partnership & Resources**

From the interviews, most respondents agreed that partnership and resources enabler is essential for a maturity model of maintenance departments. The [Respondent B] stated that making contracts aims to create a partnership, and it is important especially for a long time contract. However, the [Respondent A] affirmed that, the partnerships and resources enabler is less important because the type and model of partnership can change every time. The maintenance department can use any suppliers who are available to do the maintenance works; therefore, partnership is not necessary [Respondent A]. However, the supplier's point of view described that the maintenance department needs to develop competences for partnerships [Respondent E]. As consequences, it is still important to make a different contractual model for the Preventive maintenance and the Responsive maintenance.

### *a. Applying technology*

Nowadays, the development of technology is growing very rapidly. This can benefit the maintenance department in delivering maintenance services. The technology can be used to link the data between the suppliers and the maintenance departments for communication and partnerships [Respondent C]; [Respondent F]. The use of information systems can also benefit to check the failures and the contracts [Respondent D]. For the maintenance engineer, technology can be used to provide "quality book" in which they can suggest better performances [Respondent D]. The use of technology can link the information between each department, such as the real estate department, the maintenance department, the administration and suppliers [Respondent A]; [Respondent G]. Moreover, now it is possible to check the data and information via portable gadget that can be useful on the project site [Respondent A]. The technology used for maintenance departments is more valuable for the Planned preventive maintenance rather than the

Responsive maintenance [Respondent D]. By having appropriate technology, that connects the building systems and the supplier's system, it will reduce responsive maintenance and increase efficiency of repairing the failures [Respondent E]. It is definite that the sub aspect of applying technology is essential to incorporate in the maturity model for maintenance departments.

#### *b. Manage the collaboration with the maintenance market*

Manage the collaboration with the markets is important according to all of the interview respondents. This collaboration model has to be stated clearly in the contracts on how is the way to cooperate [Respondent C]. Moreover, it should be started from the early phase during the consultation and tender to know what the client's needs, and what kind of performances needed by the suppliers [Respondent D]. According to [Respondent B], the collaboration is more valuable for the long time contract. Moreover, the collaboration should incorporate the three parties, which are the maintenance department, the clients, and suppliers. For the Planned preventive maintenance, the collaboration focuses on the quality and expertise, whether in the Responsive maintenance, the collaboration focuses on the time and services [Respondent A].

#### *c. Setting supplier's goal*

The goals of the suppliers have to be written clearly in the contract [Respondent B]. This will make sure that the goals of the maintenance department and suppliers are the same [Respondent B]. The goals should be set together between the maintenance department, suppliers and users [Respondent E], [Respondent F]. There should be performance agreement between the suppliers and maintenance department, for instance, that 95% of the goals should be achieved during the service contract. However, according to [Respondent C], setting the supplier's goals is only valuable for the contracts but not for the planned preventive maintenance. Contrary to the other respondents, the [Respondent A] stated that setting supplier's goal is not important for a mature maintenance department, because this is not the aim of the organisation. The organisation should be more consider about the goal of the organisation.

#### *d. Manage the resources of the organisation in a sustainable way*

As a mature maintenance department, it is valuable to consider the sustainability issues toward their resources. The organisation that reflects on the sustainability can get benefit, for instance in reducing energy budget [Respondent D]; [Respondent E]; [Respondent G]. Moreover, the sustainability issue is also the organisation strategy that should be applied by the suppliers in maintaining the building assets [Respondent B]. The strategy for example, is increasing the energy level of the building [Respondent B], and using sustainable materials such as the solar panel [Respondent D]. This topic should reflect, not only when designing the Planned preventive maintenance, but also in the management of the maintenance department itself [Respondent D]. However, [Respondent A] stated that this sub aspect is less important for a mature maintenance department because this can only be applied for a new building but not for the old buildings.

There are different opinions about this sub aspect. Nevertheless, managing the resources of the organisation in a sustainable way will benefit for the maintenance department. Therefore, this sub aspect can be involved in the maturity model for maintenance departments.

#### *e. TCO/LCC*

According to the interview respondents, this sub aspect is important for a mature organisation. The use of the TCO/LCC gives more benefit for Planned preventive

maintenance, but less on Responsive maintenance. Moreover, with the DBM (Design, Build, Maintenance) contract, this element is more essential [Respondent B]; [Respondent C]; [Respondent A]; [Respondent D]; [Respondent E]. It was mentioned by [Respondent G] that for his organisation, the TCO/LCC is not important because the decision for using the TCO is in the financial department and not in the technical department. Therefore, [Respondent H] also argued that the TCO/LCC is usually decided by the Asset manager or the Real estate manager. For the maintenance department, it should be clear whether in which department the decisions are made, and how is the organisation's structures. Nevertheless, the decision made by the public organisations toward the TCO/LCC will affect the activities of the maintenance department.

#### *f. Procurement process and procedures*

This factor is important for the public organisations where maintenance activities should be done through the procurement process. However, it is also depending on the scope and the values of the projects [Respondent B]; [Respondent C].

#### *g. Appropriate contractual model*

The contract of maintenance activities will be different for the Planned preventive maintenance and the Responsive maintenance [Respondent A]; [Respondent B]. Moreover, the contract should guidelines the alternatives to create the model of partnerships and collaborations [Respondent C]. It is also important that organisation focus on the total goals of the organisation, not only for the KPI (Key performance indicators) [Respondent F]. This sub aspect is important to be incorporated in the maturity model for the maintenance department.

### 4.3.3 Leadership

A good leader can bring the organisation to perform the best quality of its people in delivering the mission and vision of the organisation (EFQM, 2012). According to the statement of [Respondent C] and [Respondent B], they agreed that leadership is one of the important factors in a mature maintenance department. The leader should be a good role model for all of the people in the organisation [Respondent E]; [Respondent F]. Nevertheless, [Respondent A] and [Respondent D] are not agree if the leadership is considered as a valuable factor for the maintenance department. The reason is that the quality of the people and staff of the maintenance department is more important. The skills and competence of the maintenance engineers and the managers are more valuable than the leader in order to make the organisation resulting the best performances [Respondent A]; [Respondent D]. Despite of the disagreement, they rendered that the sub aspect of the Leadership enabler is important. Furthermore, [Respondent D] implied that the Leadership can be valuable for the maintenance departments but in the lower priority.

#### *a. Continuously improving*

It is important that the maintenance department is always improving because the world is always changing. The leader can make sure that the organisation is always improving. Each respondent explained that this factor is important for a mature maintenance department. To cope with the improving organisation, it is important to make sure that the current strategy in the organisation is working [Respondent D]. Therefore, it is important to gain insight from the client's feedback to understand what types of improvements that they need. The improvements made in the organisation can use the PDCA (Plan, Do, Check, Act) cycles [Respondent C]. New strategies can also be adopted by the maintenance department in managing their human resources due to the changing that happen, for instance, in outsourcing the employees when the economic situation is not good [Respondent B]. In the future, the development of the maintenance

department should emphasise on the personal emotional intelligence (EQ) rather than the IQ [Respondent E]. The EQ skill is important to build communications and partnerships between stakeholders.

#### *b. Encourage integrity, transparency, effectiveness, and legality rules*

For public organisations, this sub aspect is definitely important [Respondent A]; [Respondent B]; [Respondent C]; [Respondent D]; [Respondent E]. However, [Respondent B] stated that the leader could not tackle the legality rules of public organisations. The legality rules were decided by the government level, and not by the organisational level. In the future, it is better to cut the authorisation procedures in the organisation that takes times of clients [Respondent E]. The people in the organisation can have training about the integrity, and the transparency periodically. This will increase their awareness and the consequences of breaking the rules [Respondent G].

#### *c. Manage the change & flexibility*

The maintenance departments should be able to manage the change in the organisation and be flexible such as in the contracts [Respondent B]. The stakeholders can also change every time, and their values are changing, therefore, the maintenance departments should be able to cope with the new situations [Respondent C]. Nevertheless, [Respondent D] stated that “manage the change and flexibility” is an important factor, but not primary, because the competence of the maintenance engineer and the manager of the organisation are more important to cope with the changing situations.

#### *d. Set the mission and vision of the organisation, and incorporate the people of the organisation in doing it*

Each respondent is agreeing that having a vision and mission of the organisation is an important aspect. The vision of the maintenance department is to let the market do the best things they can do [Respondent B]. This will encourage creativity of the markets and resulting in better products.

#### *e. Developing human resources*

This factor is the most important factor according to [Respondent D]. The human resources should be encouraged to increase their technical knowledge, behaviour, competence, and communication skills [Respondent C]. Providing training for employees is essential for the maintenance department [Respondent B]; [Respondent E]; [Respondent G].

### 4.3.4 People

People enabler is the most important aspect of a mature maintenance department [Respondent A]; [Respondent D]. The quality of the people who delivering maintenance services is valuable for the organisation. People in the maintenance departments should have capacity in developing relationships with the internal and the external stakeholders. To keep the knowledge and skills of the employees updated, the maintenance departments can provide training and education for the people [Respondent A]; [Respondent E].

#### *a. Innovation and creativity*

The respondent agreed that the sub aspect of innovation and creativity is important for a mature maintenance department. People working in an organisation tend to work in the same ways for several years. Therefore, they need to get stimulated in order to let the creativities out [Respondent E]. Developing innovation can be achieved by

getting the ideas from the markets [Respondent B]. For a maintenance department, it is important that the people have the technical innovation to make good standards. Creativity is important to make a good solution, especially on the site [Respondent D]. The other benefit of encouraging culture and innovation is to make people who works in the maintenance departments feel motivated and comfortable [Respondent A]. The innovation and creativity should also benefit in generating ideas to manage the sustainability and energy [Respondent C]. Nevertheless, the idea of innovation is sometimes difficult to be realised, due to the costs involved [Respondent E]. Therefore, a specific budget for innovation should be stated in advance.

#### *b. Control in organisation*

The respondents believe that control in an organisation is a valuable sub aspect of a mature maintenance department. According to [Respondent C], apart from the internal management of the maintenance department, it is also necessary to control the suppliers in delivering the Planned preventive maintenance and the Responsive maintenance. In controlling the maintenance department, the management should focus on the financial control and how to control the new ways of working [Respondent B]. By having a new way of working, employees are not necessary to come to the office; so there is less control of the people. However, people are expected to deliver their services. In addition, it is important to not over control in the organisation; therefore, working together should be encouraged [Respondent E]. The social control is more important than the rational control because the rational control can lead to opportunistic behaviour [Respondent F].

#### *c. Managing stakeholders*

Managing stakeholders is an important factor of a mature organisation. The stakeholders of the maintenance department of public organisations are the clients, the users, and the politicians [Respondent B]. Therefore, the discussion with every stakeholder should be held regularly in order to get input and understanding about the stakeholder's goals [Respondent C]; [Respondent D]. Currently, there are many levels in maintenance departments that are approached by the different levels of stakeholders [Respondent E]. For instance, the managers of suppliers will contact the strategic level of the maintenance departments, and the operational level will only contact the technical people of suppliers. In the future, the hierarchy can be removed so that the people can work together and involve external stakeholders in the collaborations [Respondent E].

#### *4.3.5 Strategy*

The maintenance department should design strategies in order to achieve the goals of the organisation, and to satisfy the clients. According to [Respondent B], having a strategy is valuable to design the future cost of maintenance. The strategy of maintenance department can be trough outsourcing the employees, and having a well-planned preventive maintenance, so that the daily maintenance is reduced.

It is also necessary to check whether the current organisation's strategy is still appropriate for the building assets, and planning for the future strategy that can benefit in cost and quality [Respondent D]. All of the respondents are agreed that this enabler is an important element for a mature maintenance department.

#### *a. Maintenance policy*

The [Respondent D] stated, that the maintenance policy could benefit the maintenance department to make sure that the strategy and policy are in line with the building functions. Furthermore, by having a maintenance policy, the organisation can be sure that the maintenance is done in the right ways. It is better to have a maintenance policy for every maintenance strategy [Respondent E]. The maintenance policies preferably

are designed per building, because every building has different characteristics [Respondent F]. On the other hand, [Respondent C] stated that the maintenance policy is not an important sub aspect of the maintenance department. According to this discussion, we assume that the sub aspect of "maintenance policy" is important for the maturity model for maintenance departments.

#### *b. Maintenance strategy (Planned preventive maintenance and Responsive maintenance)*

The interview respondents agreed that this sub aspect is valuable for a mature maintenance department. The strategy of Planned preventive maintenance can be useful for the new building, but for the older building, the strategy can use Responsive maintenance [Respondent D]; [Respondent E]. However, a different opinion were coming from [Respondent C], he stated that having these maintenance strategies are not important because there is no difference in the contract. Moreover, this is more on the operational level rather than on the strategic level.

#### 4.3.6 Conclusions for the maturity main aspects and sub aspects

Despite of many different opinions toward the maturity aspects and sub aspects, in general the interview respondents agree that all aspects are important for maintenance departments. Hence, the researcher will use all of sub aspects in the proposed maturity model into the final maturity model. Some of the respondent's opinions are reflections of their experiences in their organisations. However, it can enrich the design of the maturity levels that will be discussed in chapter 5.

### 4.4 Maturity Levels

The proposed maturity levels are presented to the respondents during the interviews. Several comments and opinions are raised and improve the level criteria. Nevertheless, the level description in proposed maturity levels is only focusing on the highest level and the lowest level. The interview respondents gave their opinions and feedbacks towards the proposed maturity levels.

#### 4.4.1 The general maturity levels according to interviews respondents

All of the respondents agreed that the definition of level 1 and level 5 are appropriate. But the discussion about the definition of level 2, 3, and 4 according to the CMM model can be improved. The general criterion of level 2 referring to the CMM by Paulk et.al (1993) is "policy is established to guide the process". According to [Respondent D], the criteria of maturity level 2 can be improved by adopting the INK (Instituut Nederlandse Kwaliteit) assessment, which is "Controlling primary processes ". This INK criterion is similar to the criteria of the CMM by Paulk et.al (1993) but more appropriate for maintenance departments [Respondent D]. Furthermore, the maintenance departments can also use the policy to control the organisation such as the ISO 9001 [Respondent D].

The proposed level 3 according to the CMM (Paulk et.al, 1993) is "Consistent and standardised". Referring to the INK, the definition of level 3 is there is "Completely systematic improvement of the organisation at all levels" [Respondent D]. The complete systematic improvement can be done, for instance by the process manager who makes sure that every process is optimised [Respondent D].

In level 4, the definition of the CMM is process is well defined, and goals are set. The definition of level 4 in the INK is "Integrating partners in the production process to share aims that can maximize value" [Respondent D]. This means that the maintenance departments should incorporating partners, suppliers, users, which are the parties outside of the organisations in developing the visions and goals.

According to the respondent's opinions, the researcher will review the development of the general maturity levels by considering the INK and the CMM models.

#### 4.4.2 Evaluation of proposed maturity levels by interview respondents

The respondents agreed to several definitions in the proposed maturity. Several additions, comments, and opinions are added:

##### A. Processes and Services

- *Performing object valuation*

The highest level of the proposed maturity level for this sub aspect is the organisation performing objects valuation as a first step of planning maintenance. In this research, the object valuation consists of two different meanings. First is the building condition assessment that evaluates the physical and technical aspects of building assets. Moreover, the second is the building valuations that cover the financial value of the building objects. All of the respondents affirmed that having the building condition's assessment standard, for instance the NEN 2767, is essential. This step allows organisations to assess the critical level of maintenance needed for building objects. [Respondent B] stated that this level could be improved with more emphasise that the maintenance department can perform object valuations for each component and the whole building objects. In addition, [Respondent D] gave an opinion about the lowest level. The lowest level can be "doing nothing" as part of the maintenance strategy. This means that there is no object valuations performed for the building objects because the maintenance activities will only carry on for responsive maintenance. Furthermore, object valuations can derives the future plan of maintenance departments [Respondent E]; [Respondent F].

For this sub aspect, the researcher decides to develop the maturity levels based on the availability of the object valuations, and the condition assessment standards used by the maintenance departments. Furthermore, the ability to integrate the process of assessing the building objects with the organisation's goals indicating that the maintenance departments are mature. For instance, if the maintenance departments are able to use the data from the object valuations and the condition assessment for long term planning in managing building assets, then that organisations are mature.

- *Supervising maintenance project*

The respondents gave an opinion toward the highest level of the proposed maturity level. The activity of supervising maintenance is intended to check the building level conditions according to the desired results [Respondent B]. The highest-level indicator of a mature organisation is the organisation gets the certification by the clients that show the satisfaction in performing maintenance services [Respondent B]. Then, [Respondent D] imply that at the highest level, a maintenance department is able to check the quality of maintenance service with them.

The researcher determines that the maturity level developments for this sub aspect are based on the capability of maintenance departments in supervising all of the maintenance processes, regardless of the scale of the activities.

- *Responding client's feedback*

The highest level of a mature maintenance department, according to [Respondent B] is the maintenance department has a system that monitoring the response of the suppliers for complaints. In addition, the maintenance departments check the feedback from the suppliers because they have more expertise in the maintenance field [Respondent D]. The maintenance departments should have standard feedback forms/questionnaires [Respondent E]. The overall results of responding client's feedback are used to evaluate the relationships between clients and suppliers [Respondent C].

In this report, the researcher will develop the maturity levels of this sub aspect into the availability of systems to process the client's feedback.

### *B. Partnership & Resources*

- *The use of technology in maintenance process and services*

The respondents agreed that nowadays technology is essential in the globalisation era. Most of the respondent's organisations use software that specific for building maintenance purpose, and link it with the financial software. The use of approved software in maintenance is important as a mature maintenance department [Respondent D]. In addition, the technology or IT system should be able to linked and synchronised with the technology of clients and suppliers to make the management more efficient [Respondent C]; [Respondent E]. The [Respondent E] added, that the maintenance department should have software that able to control the building conditions from distances.

For this sub aspect, the researcher will develop the maturity levels based on the availability of technology adopted by the organisations, and its capability for collaborative data and working together with the stakeholders. The technology shall help and improve the qualities of maintenance departments performing their tasks.

- *Manage the collaboration with the maintenance market*

Most of the respondents agreed with the proposed maturity level. A comment was coming from [Respondent B] that in the highest level of a mature maintenance department is encourage the collaborations between the suppliers and the clients. It is important that the suppliers understand the user's feeling, and the collaboration is stated clearly in the contract. Collaborations are also should incorporate the environment/broader scopes of the stakeholders [Respondent E].

The researcher will develop the maturity levels for this sub aspect by the competence of maintenance departments in doing collaborations with all maintenance markets not just the visible ones, and incorporate it in the organisation's decisions.

- *Setting the supplier's goal*

According to the respondents, it is essential to align the goals of the suppliers, the maintenance departments and the clients. The highest level of a mature maintenance department is focused on the financial goals [Respondent D]. Furthermore, the maintenance department makes the goals together with the clients [Respondent B]; [Respondent E].

For this sub aspect, the maturity level development will be the ability of the maintenance departments in setting the supplier's goals for all maintenance services, not just the visible ones.

- *Manage the resources of the organisation in a sustainable way*

The respondents agreed with the proposed maturity model. More improvement to the highest level is the organisation has efficiency by optimising the LCC, sustainability, and a right moment to perform maintenance [Respondent D]. Sustainability value is also essential to be incorporated in the budget of the maintenance department.

The maturity level development in this sub aspect will be the ability of maintenance departments in managing their resources in a sustainable way for all aspects, not only the important aspects. Furthermore, the maintenance departments should be able to incorporate it with the management objectives.

- *TCO/LCC*

The highest level of a mature maintenance department is that the TCO/LCC is used for the appropriate contracts, for instance the DBM (Design, Build, Maintenance) contract [Respondent B]. A mature maintenance department also has the LCC to check when there is a change to align the maintenance schedule and building target performances [Respondent D]. Furthermore, a mature maintenance department can use the TCO/LCC to consider about the return of investment [Respondent E].

For this sub aspect, the development of maturity levels will be the applicability of maintenance departments to incorporate the TCO/LCC in their planning and process, and to incorporate it with the management decisions.

- *Procurement process and procedures*

The highest-level definition can be improved by the comments from [Respondent D] that a mature maintenance department should be audited by the internal and the external organisation.

For this maturity aspect, the researcher will develop the maturity level's definition on the capability of the maintenance departments in performing the procurement processes according to its services or project scales.

- *Appropriate contractual model*

The interview respondent gave the opinion about the statement on the proposed maturity level for the Planned preventive maintenance and the Responsive maintenance. According to [Respondent D] the difference of contractual models is not based on the types of maintenance such as Planned preventive maintenance and Responsive maintenance, but more on different type of projects, cases or buildings.

For this sub aspect, the researcher will develop the maturity levels based on the availability of appropriate contract model for all maintenance activities, and the availability of standards for the contracts.

### C. Leadership

- *Continuously improving*

The interview respondents agreed with the proposed maturity level. The improvement focuses on the people [Respondent E]. There is also a specific strategy to cope the improvement desired.

In this sub aspect the maturity level development will be on the ability of the leaders to make sure that all areas in the organisations are continuously improving.

- *Encourage integrity, transparency, effectiveness, and legality rules.*

The lowest level of the maturity level can be indicated that the maintenance department is having risk to get involved in fraud, and not able to check the maintenance services.

For this sub aspect, the maturity level development will be the ability of the leaders to make sure that the maintenance departments are always having integrity, following legal rules, and supports the transparency and effectiveness of maintenance departments. Moreover, it should be applicable for all areas in the organisations, and integrated with the objectives of the public organisations.

- *Manage the change and flexibility*

The highest level of a mature maintenance department is the organisation knows the available information at the bottom level of organisation [Respondent B]. Furthermore, the maintenance department having the PDCA (plan, do, check, act) mechanism to make

sure that the change in the organisation is permanent and not return back to the previous position [Respondent D]. Furthermore, it is important that the people in the organisation are able to adapt to the change and be more flexible [Respondent E].

For this sub aspect, the maturity level development will be the capability of the leaders to manage the change in maintenance departments and be flexible in all areas, not only for the specific areas.

- *Set the mission and vision of the organisation, and incorporate the people of the organisation in doing it*

The opinion from [Respondent B] at the highest level of a mature maintenance department is the people in the organisation know the vision and mission of the organisation. The organisation is able to make the people and employees to act according to the vision and mission [Respondent E].

For this sub aspect, the maturity level development will be the ability of the leaders to set the mission and vision of the organisation, encourage people to apply it in the organisations, and become role models. The vision and mission of maintenance departments should in-line with the vision and mission of the public organisations.

- *Developing human resources*

The respondents agreed with the proposed maturity level for this sub aspect. In a mature maintenance department there are knowledge development given through training and education [Respondent E]; [Respondent B]; [Respondent A]. In addition, people should be encouraged to develop more on their EQ [Respondent E].

The maturity level development will focus on the ability of the leaders in developing the human resources, and recognising their skills and competence in all areas.

#### *D. People*

- *Innovation and creativity*

The respondents agreed with the proposed maturity level for this sub aspect. Furthermore, the organisation is able to focus on the costs needed for innovation [Respondent E].

For this sub aspect, the maturity level development will be the capability of the people in maintenance departments to be creative and innovative in all areas.

- *Control in organisation*

In a mature maintenance department, the skills and competences can be monitored. There is time to discuss the skills and competences with the leader [Respondent B]. In addition, the knowledge of the people about technical and management are updated and optimised [Respondent D]. The maintenance departments at the highest level are able to measure the competences of the people in the organisations [Respondent E].

The maturity developments for this sub aspect will be the ability of the maintenance departments to control the quality and productivity of its people. There is also a system to control the organisations.

- *Managing stakeholders*

The respondents agreed with the proposed maturity level for this sub aspect. The maturity level development in this sub aspect will be the ability of the maintenance departments to manage their stakeholders of all areas.

### E. Strategy

- *Maintenance policy*

The respondents agreed with the proposed maturity level for this sub aspect. In addition, the organisation has a maintenance policy for every different maintenance strategy [Respondent E].

For this sub aspect, the maturity development will be the availability of maintenance policies for all areas in maintenance departments. Furthermore, the maintenance policies should in-line with the management of the public organisations.

- *Maintenance strategy (planned preventive maintenance or responsive maintenance)*

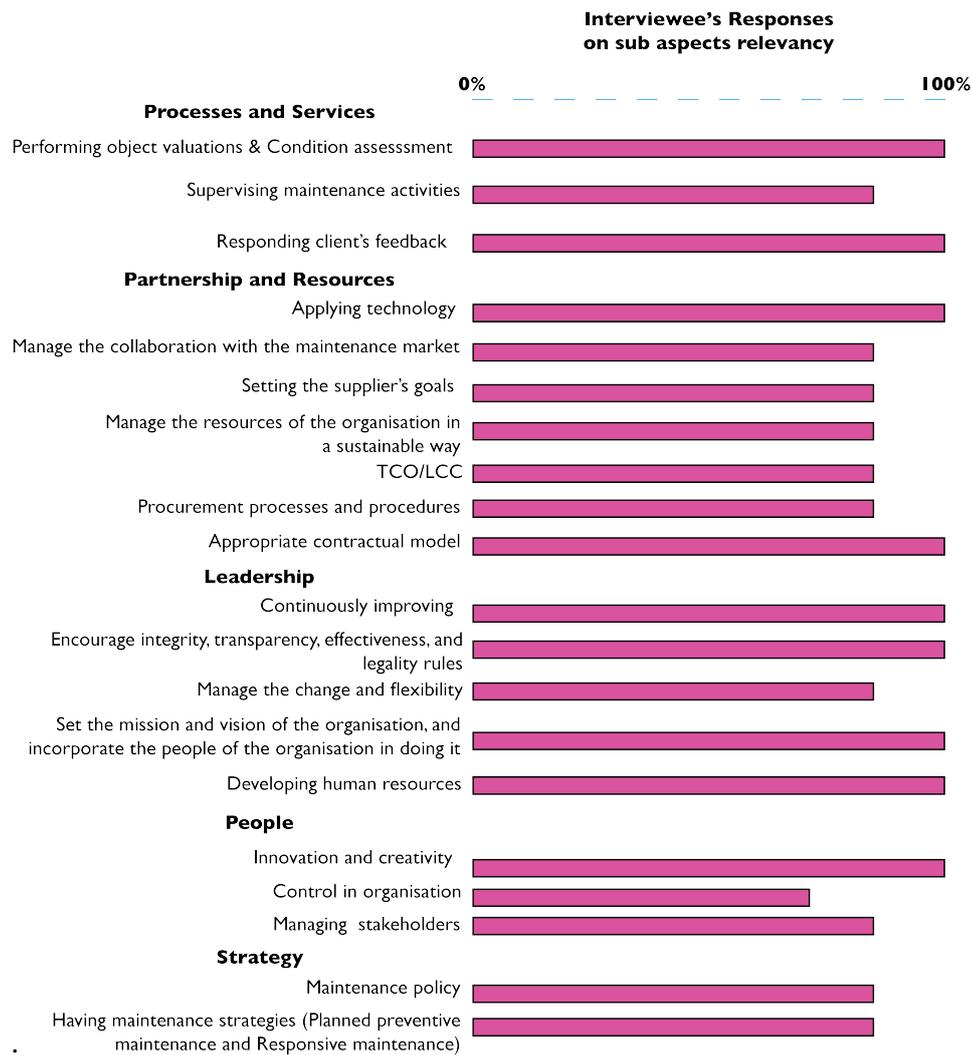
In a mature maintenance department, the Planned preventive maintenance is more important than the Responsive maintenance [Respondent B]. Therefore, the strategy should focus on the Planned preventive maintenance, which is meant to keep the building assets always in a good condition so that the Responsive maintenance is rarely delivered.

For this sub aspect, the maturity level development will be the availability of maintenance strategies for every maintenance service, and its integration with the strategies of the public organisations.

## 4.5 Conclusion

The researcher analyse the amount of the sub aspects that are marked by the interview respondents as 'agree' and 'disagree'. We calculate the 'agree' sub aspects, and divide it by the total amount of the sub aspects mentioned in the proposed maturity model, to get the percentage amount. We present it in the diagram of figure 15. This diagram purpose is to give an overview towards the sub aspects relevancies for the maturity model. However, this diagram only shows the sub aspects and not the main aspects, because the main aspects of this research are adopted from the EFQM enablers.

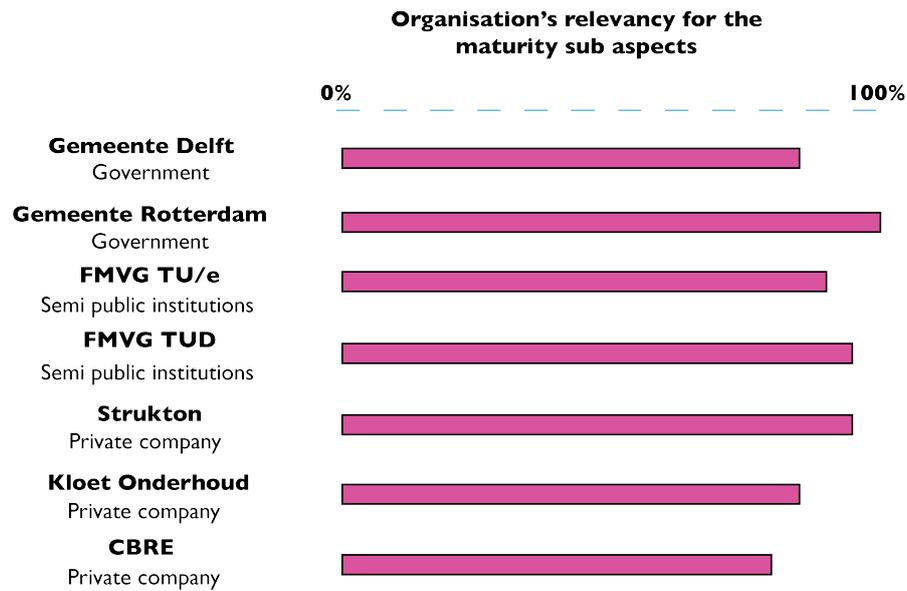
As the interview results shown in the figure 15, most of the respondents are agree that the proposed sub aspects are important to be incorporated in the maturity model for maintenance departments. A few slightly different opinions arise for some sub aspects. The lowest relevancy is coming from the "people" enabler. The sub aspect of 'control in organisation' is considered by some respondents can lead the organisation to over control and less creative. However, more than 70% of the respondents agree that this sub aspect is relevant. The other sub aspects reach 85%-100% relevancy according to the interviews. As stated in the research goals that this research will emphasise on the Planned preventive maintenance and the Responsive maintenance, according to the respondents, these are not much affecting the maintenance departments. They argued that the types of maintenance strategies would only have differences in the contracts.



**Figure 15 Relevancies of the maturity sub aspects according to the interview respondents (interview transcripts, 2015)**

The interview respondents are from different types of organisations, which are public organisations such as government and semi public universities, and private organisations such as suppliers and real estate companies. These private companies are having experiences working with the public organisations. The purpose of involving these private organisations in these interviews is to get broader views and objective results.

We calculate the sub aspects that are marked as 'agree' by the interview respondents according to their types of organisations. It is shown in figure 16 that most of the respondents from different organisational backgrounds have similar views toward the maturity sub aspects. The least relevant organisation is the real estate company, because its exposure into public organisation's projects is limited. Furthermore, the goals of the real estate company are more on profit oriented, and user satisfactions.



**Figure 16** The maturity sub aspects relevancy according to different types of organisations (interview transcripts, 2015)

The results from the interviews can be biased because of the subjectivity of the respondents, their experiences toward the public organisations, the department in which they are working in, and their own interests. Apart from the subjectivities, the outcomes of the interviews are enriching the literature studies, and relevant to real professional works. Furthermore, in developing the maturity levels, the respondent's opinions are valuable. As a final conclusion of this chapter, the maturity aspects derived from literature reviews are relevant to be integrated in the maturity model for maintenance departments of public organisations.

**DESIGNING  
THE MATURITY  
MODEL**

**5**

## CHAPTER 5

### DESIGNING THE MATURITY MODEL

This chapter describes the process of designing the maturity model. The first part is to input the proposed maturity aspects that are then integrated with the proposed maturity levels. The maturity levels described here are the results of the interview method and the literature reviews.

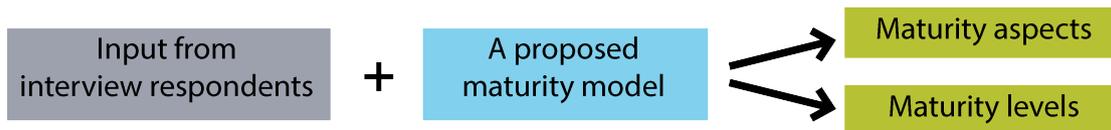


Figure 17 The fourth research step

The results of the interviews with experts give information and knowledge to complement the results of the literature reviews. As the results of the interviews might have subjectivities, the researcher decides to verify with the data from the literature review. As a result, the final maturity levels and the maturity aspects are then designed.

#### 5.1 The development of maturity levels

The maturity levels for every sub aspect are integrating the levels of the CMM (Capability Maturity Model) and the results of interviews. The maturity levels, according to Paulk et.al (1993) should ascertain the differences between the mature and immature organisations. Therefore, the level's development in the maintenance maturity levels must clear. The difficulty in developing the maturity levels in this research is the lack of theoretical support for each stage of key aspects that based only on the experience of the expert. In this research, the development of each maturity level will link the key aspects (the important criteria) of maintenance departments, the maturity levels of the CMM (Capability Maturity Model) and the opinions of interview respondents.

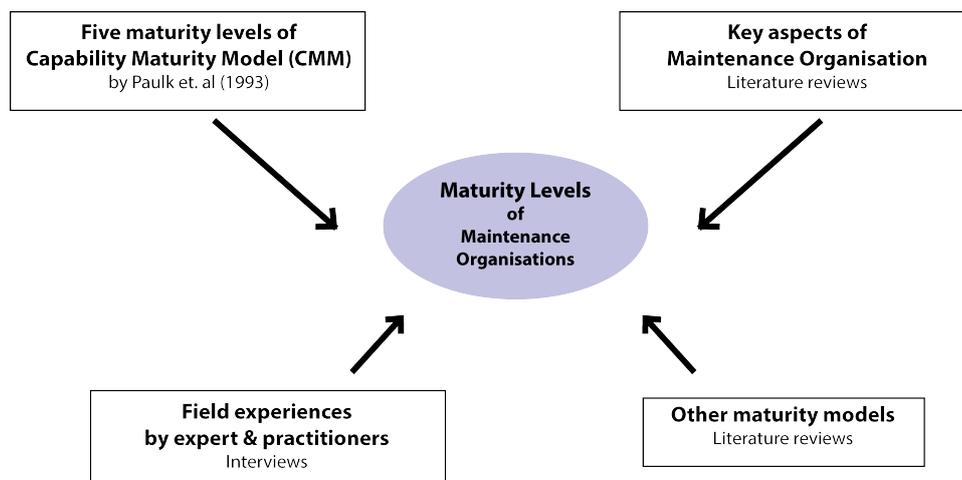


Figure 18 The development of the maturity levels

The processes of developing the maturity levels are started from the proposed maturity levels that have the highest level and the lowest level. From that concept, the researcher starts to gather the respondent’s opinions and feedbacks. Most of the respondents describe their ideal vision toward the highest level of a mature maintenance department. The respondent’s opinions are then compiled with the maturity level descriptions of the CMM (Capability Maturity Model), the PCMM (Public Commissioning Maturity Model), other maturity models, for instance The Project management maturity model, and the INK (the Netherlands Quality Institute).

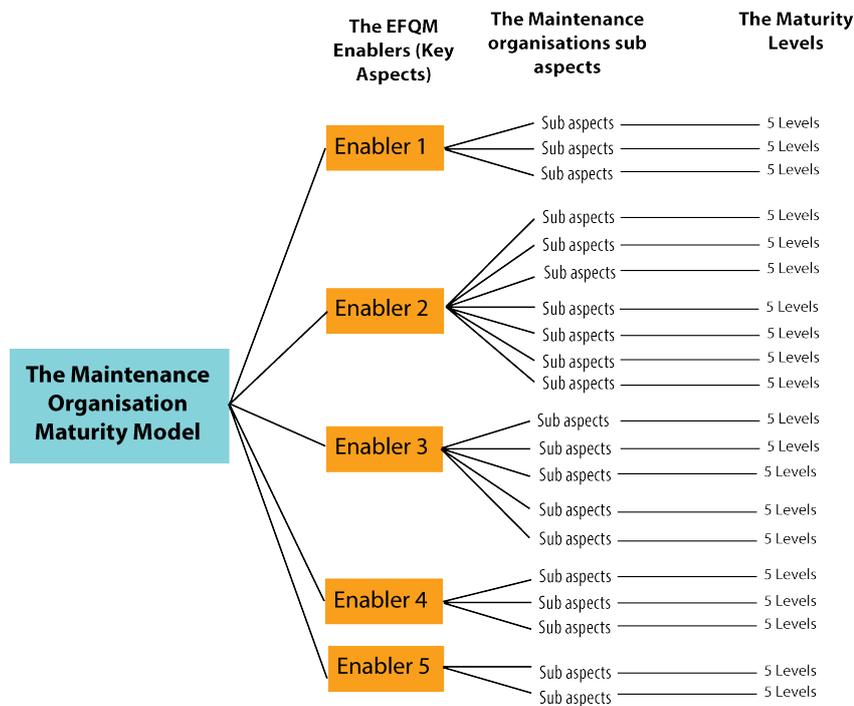


Figure 19 The concept of the maturity model (own illustration, 2015)

The maturity levels are explained for every main aspect and sub aspects of the proposed maturity model. This can guide the maintenance departments, which will take the maturity assessment test to evaluate their maturity into more detailed activities that they performed. Furthermore, this will increase the organisation’s awareness about their professionalism in performing activities related to every sub aspect.

### 5.1.1 General maturity levels

The general maturity levels are involving the aspects of the CMM by Paulk et.al (1993) and the respondents’ experiences with the INK (Instituut Nederlandse Kwaliteit) assessment. The results are described in the table below:

Table 10 General maturity levels (source: own finding, 2015; Paulk et.al (1993); INK (2015))

THE MAINTENANCE DEPARTMENTS MATURITY LEVELS		
LEVEL 1	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>Chaotic condition</li> </ul>
LEVEL 2	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>Policy is established to guide the processes.</li> <li>Controlling primary processes.</li> <li>Process-based disorders.</li> <li>Control through performance indicators.</li> </ul>
LEVEL 3	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>Consistent and standardized</li> <li>At all levels, there are entirely systematic improvements of the</li> </ul>

		company.
		<ul style="list-style-type: none"> <li>• PDCA applied everywhere.</li> <li>• Customer focus is dominant for the policy.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>• Processes are well defined and goals are set.</li> <li>• Together with its partners in the production process shall aim to maximize value.</li> <li>• Operating systems are connected with each other.</li> <li>• Innovation is paramount.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>• Integrated management, focusing on improvement</li> <li>• Organisation has integral quality of managing all risk factors such as commercial, technical, effectiveness, efficiency, exploit, financial, and cancellation</li> </ul>

The general maturity levels explain that when the level is higher, the systems and processes in the organisation are increasing. In this research, the aspects of the EFQM enablers are divided into sub aspects to give more specific focus of the maturity model self-assessment. By having several sub aspects, it is expected that the results of the assessment using this maturity model will be more valid and appropriate for the maintenance departments.

### 5.1.2 Maturity levels of Processes & Services

The table shows the development of levels in a maintenance department within the scope of the EFQM enabler of processes and services. Furthermore, the results of literature reviews and interviews are incorporated into this table. As shown below, the processes in the maintenance department are developing, following the increasing of the maturity levels.

**Table 11 Maturity levels of Processes & services**

<b>MATURITY LEVELS OF PROCESSES &amp; SERVICES</b>		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>• The organisation has not set clear procedures for delivering maintenance services. The people work according emerging needs of the organisation. The organisation success in maintenance processes is depending on individual performances.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>• The organisation has basic standard procedures to deliver the maintenance process only for specific maintenance services. The organisation plans their maintenance services based on the previous project success. Their project estimations are based on the expert knowledge.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>• The organisation has standard maintenance processes that are consistent and integrated for most all maintenance services. The management can track the progress of their maintenance services. The organisation's project estimations are based on their organisation standards.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>• The organisation has maintenance processes that are integrated with their mission of organisation success. The management uses the data and involving stakeholders to make decisions.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>• The organisation has processes to evaluate their effectiveness and efficiency of delivering maintenance services. The organisation's goal is to improve their maintenance performances.</li> </ul>

This first enabler is divided into three sub aspects as follows:

### A. Performing Object valuations

Table 12 Maturity levels of Performing object valuations

PERFORMING OBJECT VALUATIONS		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation does not have specific standards (e.g. accounting standard for building financial value) for the assessment. Their assessments are based on the emerging needs and driven by the individual.</li> <li>The organisation does not have specific standards (e.g. NEN 2767) for the assessment. Their assessment are based on emerging needs and driven by the individual.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation uses their standardised procedures to value the building objects of which the bigger scale maintenance services will be performed. The organisation uses its own standards.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation uses national standardised procedures to assess the building objects for most all scales of maintenance services.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation value the building objects, compile the data, and then they use and share it for all levels in their organisation management and for their stakeholders.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation recognises their strengths and weaknesses in valuing the building objects and learn from it. The organisation always improves their processes in valuing the building objects.</li> </ul>

### B. Supervising maintenance activities

Table 13 Supervising maintenance activities

SUPERVISING MAINTENANCE ACTIVITIES		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation supervises their maintenance process when it is needed, and mostly initiated by individual effort.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation has standard procedures for supervising maintenance (e.g. standard procedures defined by its own organisation). The organisation mostly supervises the visible/bigger maintenance activities.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation supervises all of the maintenance activities based on the standard procedures we have.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation supervises all of the maintenance activities and they involve suppliers to do it. The organisation wants to add value and get insights from the stakeholders by working together in supervising their maintenance services.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation evaluates their efficiency and effectiveness of supervising maintenance activities. The organisation wants to learn from their strengths and weaknesses in order to always improving.</li> </ul>

### C. Responding client's feedbacks

Table 14 Responding Client's feedbacks

RESPONDING CLIENT'S FEEDBACK		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation response to feedback when it is emerges. They do not have clear procedures or systems in response to feedback.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation has established systems (e.g. forms, questionnaires, online feedback, etc.) to respond the feedbacks from clients. The organisation asks feedbacks from their bigger clients to know their satisfaction levels and they respond some of their feedback.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation is consistently using their standardised systems to response feedbacks from clients. The organisation asks feedbacks from all of their clients and responds most of their feedbacks.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation uses the data from client's feedbacks to make decisions in the organisation management. The organisation also asks feedbacks from other stakeholders in order to innovate in their maintenance services.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation evaluates their systems and responses to client's feedbacks. The organisation reviews its strengths and weaknesses. The organisation always improves their systems to respond the feedbacks.</li> </ul>

### 5.1.3 Maturity levels of Partnerships and Resources

Table 15 Partnerships and resources

MATURITY LEVELS OF PARTNERSHIPS AND RESOURCES		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation does not have clear procedures to manage their partnerships and resources. The organisation matches their needs and their available resources only when the maintenance services have to be delivered.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation has their re-courses documented to fit with the important maintenance processes/activities. The organisation establishes partnerships with their important clients, suppliers, and stakeholders.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation plans their resources to meet with the overall process for the specific needs in the organisation. The organisation develops their partnerships with all of the clients, suppliers, and stakeholders.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation is able to manage their resources to fit and support the success of entire organisation's activities. Their partnerships with clients, suppliers, and stakeholders are well defined, and the organisation is seeking for innovation in the partnerships model.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation learns from their strengths and weaknesses to improve their partnerships and resources management.</li> </ul>

This second enabler is divided into seven sub aspects as follows:

### A. *Applying technology*

**Table 16 Applying technology**

<b>APPLYING TECHNOLOGY</b>		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation uses basic technology (e.g. Microsoft office) to support the maintenance processes.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation uses specific IT system to support the specific maintenance processes.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation uses an integrated IT system that supports all of our maintenance processes.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation uses IT systems applicable for delivering maintenance services that are in line with the organisation's management systems. The organisation is able to incorporate data from their clients, suppliers, and stakeholders.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation has very well integrated IT systems and they evaluate its efficiency and effectiveness to seek improvement.</li> </ul>

### B. *Manage the collaboration with the maintenance market*

**Table 17 Manage the collaboration**

<b>MANAGE THE COLLABORATION</b>		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation manages the collaboration with the maintenance market when it is needed. The collaboration is developed depending on individual willingness.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation is engaged with the most important and visible maintenance markets and we are able to develop mutual collaboration. They plan their meeting frequently.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation is able to manage their collaboration with most all of the maintenance markets. Their relationships are consistent.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation manages the collaboration with all maintenance markets to support the success of the management of our organisation. The organisation has involved their clients and stakeholders in managing the maintenance markets.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation evaluates the strengths and weaknesses in managing their collaboration with the maintenance market and improves it.</li> </ul>

### C. *Setting the supplier's goal*

**Table 18 Setting the supplier's goal**

<b>SETTING THE SUPPLIER'S GOAL</b>		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation sets the supplier's goals immediately when they want to perform the maintenance tasks.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation has defined standard goals for the suppliers. The goals are clearly stated in the contract for specific/visible</li> </ul>

<b>LEVEL 3</b>	<b>DEFINED</b>	<p>maintenance services.</p> <ul style="list-style-type: none"> <li>The organisation has consistent and standardised goals for the suppliers. The standard goals are integrated, and clearly stated for all maintenance services.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation sets the supplier's goals together with clients and suppliers. The organisation sets the supplier's goals that in-line and integrated with the organisation's management goals.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation has well defined supplier's goals. Therefore, they evaluate its efficiency and effectiveness of the goals. They learn from it and improve it.</li> </ul>

#### *D. Manage the resources of the organisation in a sustainable way*

**Table 19 Manage the resources in a sustainable way**

<b>MANAGE THE RESOURCES IN A SUSTAINABLE WAY</b>		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation manages the resources, but they do not think that managing it in a sustainable way is necessary.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation has established procedures to manage the organisational resources in sustainable ways for specific needs.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation has standardised and consistent procedures to manage their resources in sustainable ways for all areas of the organisation.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation manages their resources in sustainable ways to support the success of the organisation management. The organisation is involving their partners, clients, and stakeholders to support it.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation has excellent management of their resources that are integrated and organised. The organisations evaluate the strengths and weaknesses, and seeking for improvement.</li> </ul>

#### *E. TCO/LCC*

**Table 20 TCO/LCC**

<b>TCO/LCC</b>		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation does not think that the TCO/LCC is applicable to use for the organisation.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation uses TCO/LCC only for appropriate contract (e.g. DBM contract) and specific circumstances.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation has standardised and consistent procedures to use TCO/LCC and implement it in all their maintenance services.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation uses TCO/LCC for all our maintenance activities and make sure that it is in-line with the management in the organisation.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation evaluates the efficiency and effectiveness of using the TCO/LCC in our organisation; the organisation learns from it and improves it.</li> </ul>

## F. Procurement process and procedures

Table 21 Procurement process and procedures

PROCUREMENT PROCESS AND PROCEDURES		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation performs procurement, though we do not have standardised process and procedures. The organisation's methods are matched with the emerge condition.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation establishes procurement procedures for specific maintenance activities. The procurement processes are mostly delivered for bigger/visible maintenance projects.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation has procurement process and procedures that are standardised and consistent for all types of maintenance services and projects.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation's decisions in the procurement process are in-line with the organisation's management perspectives. The organisation involves their clients, suppliers, and stakeholders to support the procurement processes.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation reviews their procurement processes and improve it to focus on its effectiveness and efficiency.</li> </ul>

## G. Appropriate contractual model

Table 22 Appropriate contractual models

APPROPRIATE CONTRACTUAL MODEL		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation sets contracts for maintenance activities nearly the ended of the delivery time. They do not have specific contractual models for different maintenance activities.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation has standard contractual models for specifics/visible maintenance activities.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation has consistent and standardised contractual models for all types of maintenance activities.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation has contractual models that are defined together with their clients about what are the appropriate maintenance strategies that will be provided by them. The contractual models are supporting the mission of the management organisation. The organisation is always innovating our contractual models.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation has excellent contractual models for different maintenance strategies; and they evaluate its strengths and the weaknesses. The organisation always seeks for improvement.</li> </ul>

### 5.1.4 Maturity levels of Leadership

Table 23 Leadership (source: own finding, 2015; INK, 2015)

MATURITY LEVELS OF LEADERSHIP		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The leaders are having difficulty in establishing the vision and mission for the people in the organisation. The organisation's leaders cannot become role models, and having difficulty to manage the maintenance processes. People are not encouraged to follow the organisation's value.</li> </ul>

<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The leaders set vision and mission. The leaders act as role models following the organisation's value. The leaders encourage people to apply their mission to focus on their maintenance processes.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The leaders are able to plan the processes and manage the people in their organisation to apply organisation's mission for all processes in the organisation.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The leaders are able to manage the strengths and competences of the organisation and make sure that the value is in-line with the value of the management organisation.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The leaders evaluate the organisation's strengths and weaknesses and improve it.</li> </ul>

### A. Continuously improving

Table 24 Continuously improving

#### CONTINUOUSLY IMPROVING

<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The leaders do not set the plan for organisational improvement. Improvement in the organisation is based on individual effort.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The leaders establish guidelines and plan to make sure that their organisation to always improve only for the specific/visible areas.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The leaders set clear strategies that consistent and standardised to improve the organisation in all areas.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The leaders make sure that the organisation improvement is in line with our organisation management. The organisation is involving clients and stake holder's opinions in order to improve and innovate.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The leaders monitor and review the organisation's plan for improvement. The organisation always seeks for the most effective and efficient improvement.</li> </ul>

### B. Encourage integrity, transparency, effectiveness, and legality rules

Table 25 Encourage integrity, transparency, effectiveness, and legality rules

#### ENCOURAGE INTEGRITY, TRANSPARENCY, EFFECTIVENESS, AND LEGALITY RULES

<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The leaders cannot promote integrity, transparency, and effectiveness in the organisation because of unclear legality rules. There are risks of fraud in the maintenance processes.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation has clear policies and legality rules toward transparency, integrity, and effectiveness only for the maintenance processes. People understand and follow the legality rules.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The leaders bring the spirit of transparency, integrity and effectiveness in all processes and aspects of the organisation. The rules and regulations are consistent and standardised.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The leaders are working together with clients and stakeholders to create the environment of transparency, integrity, and effectiveness. The legality rules are communicated well, and always innovated.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The state of legality rules, transparency, integrity, and effectiveness in the organisation are very well integrated. The leaders evaluate and improve it.</li> </ul>

### C. Manage the change & flexibility

Table 26 Manage the change and flexibility

MANAGE THE CHANGE AND FLEXIBILITY		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The leaders manage the change in the organisation when it is emerged and needed. The leaders are not flexible.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The leaders have clear guidance to manage the changes and they are flexible for specific primary activities and areas.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The leaders are able to manage the change and flexibility through standardise and consistent strategies (e.g. PDCA (plan, do, check, act)) for all activities and areas.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The leaders make sure that our changes are supporting the success of our organisation management. They are flexible and involve partners, clients, and stakeholders to encourage positive changing.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation's management of change and flexibility are well integrated. Therefore, the leaders review the change and flexibility in the organisation and always seek for improvement.</li> </ul>

### D. Set the mission and vision of the organisation

Table 27 Set the mission and vision of the organisation

SET THE MISSION AND VISION OF THE ORGANISATION		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The leaders have difficulty to set the vision and mission. The people in the organisation cannot recognise what the mission and vision are.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The leaders are able to set the vision and deliver it in the form of mission for the specific/visible maintenance processes. People recognise it.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The leaders set the vision and mission for all aspects of the organisation and make sure that the people understand and apply it into their organisation.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The leader sets the vision and mission that support the success of all levels in the organisation management. The organisation makes sure their clients and stakeholders understand it.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation's vision and mission are very well integrated in our management system. Their leaders review and improve it.</li> </ul>

### E. Developing human resources

Table 28 Developing human resources

DEVELOPING HUMAN RESOURCES		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation's leaders develop human resources to match with the needs. The organisation does not measure the competence and skills of the people in their organisation.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation has systematically established (e.g. career path) to develop the capabilities of our human resources. The competence and skills of the people are recognised by their leaders. The leaders focus on development for the employees</li> </ul>

<b>LEVEL 3</b>	<b>DEFINED</b>	<p>on specific/visible areas.</p> <ul style="list-style-type: none"> <li>The organisation's leaders set the procedures to develop human resources that are consistent and standardised. People of all areas and levels are trained to improve their skills and capabilities. The organisation's leaders focus on the development of skills and competence of the people of all areas.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation's leaders train the people in their organisation to support the success of an organisation's management. The people's performances are measured, and are integrated with the career development.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation has excellence procedures and process to develop their human resources. Their leaders evaluate it and always seek for improvement.</li> </ul>

### 5.1.5 Maturity levels of People

Table 29 Maturity levels of People

<b>MATURITY LEVELS OF PEOPLE</b>		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>People are important for the organisation, but the skills and competence of the people are difficult to recognised. The success of the organisation is depending on the individual effort.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation develops procedures to recognise the skills and competences of people in their organisation.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation has consistent and standardised procedures to recognise and to manage the skills and competences of their people. The organisation has a people development program that in line with the maintenance department's career path.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation measures the competences and skills of their people and integrates it with the career development in the organisation management.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The management of the people in the organisation are well integrated. The organisation evaluates the systems and seeking for improvement.</li> </ul>

#### A. Innovation & creativity

Table 30 Maturity levels of Innovation and creativity

<b>INNOVATION AND CREATIVITY</b>		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>People in the organisation have no encouragement to be innovative and creative in the organisation.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>People are encouraged to be innovative and creative, mostly for the visible/bigger maintenance activities.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation have standardised procedures that encourage innovation and creativity for all aspects and activities in the organisation.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>People are encouraged to be creative and innovative for all processes that support the success of their integral organisation management.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation review and evaluate their output by encouraging innovation and creativity. The organisation is</li> </ul>

seeking for the innovations that bring the most efficient and effective processes. The organisation is known their strengths and weaknesses and improves it.

### B. Control in Organisation

Table 31 Maturity levels of Control in organisation

CONTROL IN ORGANISATION		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation has a unclear system to control the skills and competence of the people and they use it only when a crisis happened in the organisation.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation has procedures established (e.g. reward systems, monthly evaluation) to control the quality and competence of the people. The organisation is able to control the people and their performance only for the visible/specific maintenance activities.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation's system to control the people is standardised and consistent. People are responsible for their own products &amp; qualities, more competitive, and able to adapt to the new ways of working. The organisation's control system covers all levels and activities in our department.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The processes of controlling the people in the organisation are well defined. People are able to develop the collaboration and working together with stakeholders. The organisation is able to measure the competencies to control the output of maintenance. The organisation's control systems are aiming for the success of organisation's management.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation has well integrated control systems. The organisation evaluates their control systems and improves it.</li> </ul>

### C. Managing stakeholders

Table 32 Maturity levels of Managing stakeholders

MANAGING STAKEHOLDERS		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation manages their stakeholders when we need it.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation has awareness and procedures established (e.g. weekly meeting, monthly meeting) to manage their relationship with the stakeholders. The organisation maintains the relationship with the stakeholders to control the quality of their primary maintenance activities.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation have standardised procedures and system to manage the stakeholders. The organisation maintains the relationship with their stakeholders to control the quality of all maintenance activities.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation has well defined processes of managing the stakeholders. The organisation is able to working together with stakeholders in order to support the goals of the organisation management.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation evaluates their approach in managing their stakeholders and seeking improvement for the most efficient and effective ways.</li> </ul>

### 5.1.6 Maturity levels of Strategy

Table 33 Maturity levels of Strategy

MATURITY LEVELS OF STRATEGY		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation has no planned strategy, but it will emerge when it is needed.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation has clear strategies. Their strategy aims to control the primary process and the primary maintenance activities.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation has standardised and consistent strategies. Their strategies are applicable to all processes and activities in their organisation.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation's strategies are integrated, and support the success of the management of the organisation. The organisation always innovates to seek the best strategies.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation evaluates their strategies. The organisation knows their strengths and weaknesses and they improve it.</li> </ul>

#### A. Maintenance policy

Table 34 Maturity levels of Maintenance policy

MAINTENANCE POLICY		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation does not have clear maintenance policies. We use it when necessary.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation established standardised maintenance policies to guide their maintenance process. The organisation has maintenance policies available only for visible/primary maintenance processes.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation maintenance policies are consistent and standardised. It applied for all maintenance processes.</li> </ul>
<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation maintenance policies are well defined, integrated, and supports their organisation's management.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation evaluates their maintenance policies. The organisation always seeks for improvement for the most effective and efficient policies.</li> </ul>

#### B. Maintenance strategy

Table 35 Maturity levels of Maintenance strategy

MAINTENANCE STRATEGY		
<b>LEVEL 1</b>	<b>INITIAL</b>	<ul style="list-style-type: none"> <li>The organisation does not have awareness towards the importance of make different maintenance strategies (e.g. planned preventive maintenance and responsive maintenance). The organisation's maintenance strategy used is based on their needs. They have no clear maintenance plan.</li> </ul>
<b>LEVEL 2</b>	<b>REPEATABLE</b>	<ul style="list-style-type: none"> <li>The organisation has maintenance strategies that are set for different types of maintenance services, only for the visible/primary scale of maintenance projects.</li> </ul>
<b>LEVEL 3</b>	<b>DEFINED</b>	<ul style="list-style-type: none"> <li>The organisation has maintenance strategies that are consistent and standardised. Their different strategies of planned preventive maintenance and responsive maintenance cover all scales of maintenance.</li> </ul>

<b>LEVEL 4</b>	<b>MANAGED</b>	<ul style="list-style-type: none"> <li>The organisation maintenance strategies are well defined. The types of their maintenance strategies are aiming to support the organisation management. The organisation always innovates to seek what maintenance strategies that are appropriate to use.</li> </ul>
<b>LEVEL 5</b>	<b>OPTIMIZING</b>	<ul style="list-style-type: none"> <li>The organisation's maintenance strategies are integrated with the management system. The organisation evaluates their efficiency and the effectiveness in order to improve it.</li> </ul>

## 5.2 The new maturity model vs. the proposed model

There are no differences between the proposed maturity model and the new maturity model. All aspects and sub aspects are relevant according to the literature reviews and the interviews. The model enhancements are in the descriptions of the maturity levels. The important issue that is become a focus is whether involving the Planned preventive maintenance and Responsive maintenance as sub aspects in the model is necessary or not. Some experts argue that the distinction of Planned preventive maintenance and Responsive maintenance in different contractual model is essential. Nevertheless, to make this different strategy become the focus of the organisation process is not relevant. However, the expert from the supplier organisations agrees that there should be a distinction between Planned preventive maintenance and Responsive maintenance.

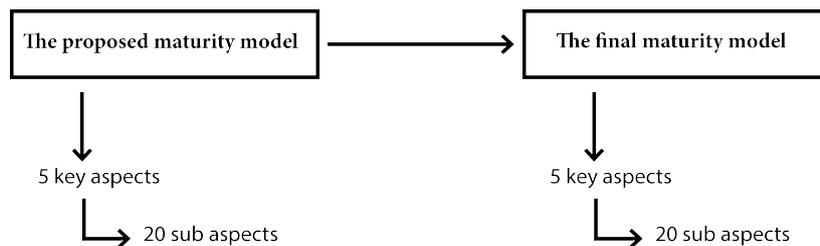


Figure 20 The proposed maturity model vs. the final maturity model

## 5.3 Conclusions

According to the interview results, the enablers and sub aspects are relevant for building the maturity model for maintenance department. Several enhancements are implemented for the maturity levels development. The development of the maturity levels has a difficulty in which the resource of each stage is based on the researcher's interpretation toward the results of literature reviews and interviews.

A remarkable opinion from interviews with experts is to see the maintenance as an integral process that should incorporate every aspect and risks in managing building assets that involving stakeholders from inside and outside of the organisation. Almost of all respondents were agreed that the future improvement for maintenance departments is the concept of working together with every stakeholder and enhance the partnerships. Furthermore, the goals of maintenance should in line with the goals of the organisation. In addition, according to the main research goals, it can be concluded that the maturity levels are not different in terms of Planned preventive maintenance and Responsive maintenance.

As a conclusion, from overall maturity levels per sub aspects that have been described above, it has several characteristics:

### *Characteristic of Level 1*

At level 1, a maintenance department has a basic or standard approach in performing their activities. The organisations have little awareness toward their process and strategies. Furthermore, the management of their documentation is only for the main tasks.

### *Characteristic of Level 2*

At level 2, a maintenance department has increased their awareness. Procedures are made. However, they start to use specific tools only for their specific or major activities that are visible to their organisation. The relationships with the stakeholders are only with the main partners.

### *Characteristic of Level 3*

At level 3, a maintenance department already has well developed processes and systems that connected to all aspects of activities. The processes in the organisations are standardised.

### *Characteristic of Level 4*

At level 4, a maintenance department can integrate their processes, procedures, and all aspects that support their activities with the management of the public organisation. For instance, if the maintenance department is part of the Department of Real estate, then the maintenance department can synchronise and integrates their management decisions with the decisions of the Head of the Real estate department.

### *Characteristic of Level 5*

At level 5, that is the ultimate level where the maintenance department has the perfect management systems and starts to evaluate their own strengths and weaknesses. In this level, a maintenance department will seek for improvement by learning from their strengths areas.

# DESIGNING THE ASSESSMENT SHEET

# 6

## CHAPTER 6

### DESIGNING THE ASSESSMENT SHEET

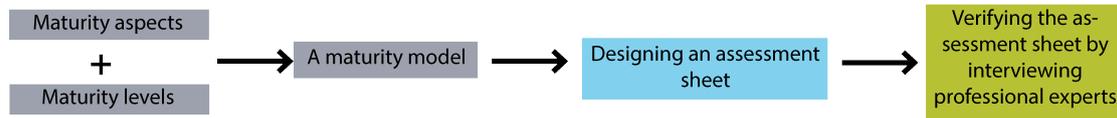


Figure 21 The fifth research step

To test the maturity levels of maintenance departments, we design a maturity model and its assessment sheet. The assessment sheet can be used to discover the maturity levels of maintenance departments by answering the questions. From the answers selected by the maintenance departments, we can reveal what is their position by calculating its score. This is a simple method where the maintenance departments can do it by themselves as a self-assessment method.

For this research, the concept design of the assessment sheet is to give questions according to the maturity main aspects and sub aspects, and provides it with the multiple-choice answers. There are five multiple answers provided from a, b, to e. Each answer represents the maturity levels. Answer 'a' is the maturity level 1, followed by answer 'b' as the level 2, up to answer 'e' as the level 5. The design of the proposed assessment sheet is presented in [APPENDIX IV](#).

The assessment sheet consists of 26 questions that are divided into five parts. The first part is about the first enabler, Processes and services. In order to make the question clear for the respondents, the sub aspect of "Performing object valuation and condition assessment" is split into two questions. The development of the maturity model into the assessment sheet can be seen in the table below.

Table 36 the development of the Maturity model into assessment sheet

Maturity aspects (the EFQM enablers)	Maturity Sub Aspects	Number of question(s)
<b>1 Processes and services</b>	Performing object valuation & condition assessment	2
	Supervising maintenance activities	1
	Responding client's feedback	1
	<b>2 Partnership and resources</b>	1
	Applying technology	1
	Manage the collaboration with the maintenance market	1
	Setting the supplier's goal	1
	Manage the resources of the organisation in a sustainable way	1
	TCO/LCC	1

	Procurement process and procedures	1
	Appropriate contractual model	1
<b>3</b>	<b>Leadership</b>	1
	Continuously improving	1
	Encourage integrity, transparency, effectiveness, and legality rules	1
	Manage the change and flexibility	1
	Set the mission and vision of the organisation, and incorporate the people of the organisation in doing it	1
	Developing human resources	1
<b>4</b>	<b>People</b>	1
	Innovation and creativity	1
	Control in organisation	1
	Managing stakeholders	1
<b>5</b>	<b>Strategy</b>	1
	Maintenance policy	1
	Having maintenance strategy (Planned Preventive maintenance and Responsive maintenance)	1

After formulating the proposed assessment sheet, the second round interviews were delivered. The purpose of the second round interviews is to check whether the questions and the multiple choices in the proposed assessment sheet are relevant and can be used to measure the maturity of maintenance departments. The results of the interviews are used to determine of which questions and multiple choices that should be improved, added or removed from the sheets. Furthermore, during the second round interviews, the researcher received feedbacks to improve the maturity levels.

### 6.1 Respondents view toward the proposed assessment sheet

To verify the relevancy of the assessment sheet, several interviews have been conducted.

#### *a. An expert from Real Estate Company*

During the interview, the respondents gave feedbacks and opinions toward the maturity aspects. The results are presented in chapter 4. When reviewing the proposed assessment sheet, the expert from Real Estate Company explains that all of the questions in the assessment sheet are relevant to be used by his organisation, except the question about the TCO/LCC. He argued that the concept of the TCO/LCC could only be used by the higher management level, and not in his department. Because the respondent is in the technical departments, therefore they are not responsible to involve the TCO/LCC in their calculation. This task is belongs to the financial departments and the higher level managers. He argued that for the maintenance department that only has a smaller budget, they do not need a longer plan such in the TCO/LCC. The respondents also thought that the assessment sheet is relevant to be used by the maintenance departments of public organisations.

### b. An expert from Maintenance Consulting Company

The expert from this company discusses many questions in the assessment sheet that can be improved. The main emphasis from this expert is that the researcher should understand the scope of the organisations that will be assessed.

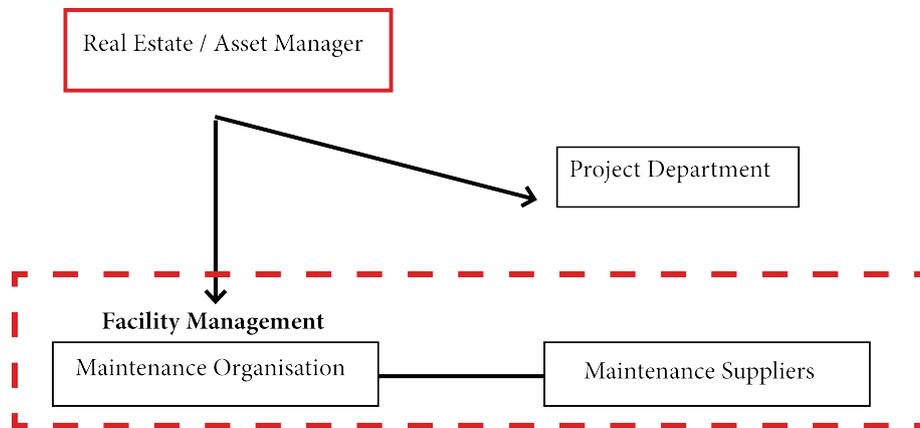


Figure 22 the structure organisation (source: interview with expert from consulting company, 2015)

The diagram shows the common structural organisation of maintenance departments. According to the respondent, mostly the maintenance departments of public organisations are under the real estate management or the asset manager. Therefore, in the assessment sheet, the designed questions should imply the position of the department in the organisation. For instance, the questions that covering the cost and budget for longer-term plan are considered aiming the real estate manager. Meanwhile, the short-term plan is a scope of the maintenance department.

When discussing the first part of the assessment sheet, about the “Processes and services” enabler, the respondent has opinion toward the context of the object assessment and the condition assessment. There are five questions in this part. In this area, there should be distinctions between the building functions and the installations. Furthermore, there are more standard that can be used as an indicator of a mature organisation beside the NEN 2767, such as NEN 8021 about building performances, and the ISSO publications that cover the standard of installations. The assessment questions for the first enabler then can be added according to those distinctions.

The second part is the “Partnerships and resources” enabler that has eight questions. On the question about sub aspect of “technology”, the question should also emphasise on what kind of ICT (Information and communication technology) tools that can be used, because of each different level of the department will need a different tool. For instance, in the level of facility manager it is preferable to use ‘Plano’ software to gather the data. Nevertheless, on the level of asset manager, they will use software to support the financial data, and on the level of maintenance suppliers, they will use software to view work orders. Despite of the different types of software that are used by maintenance departments, the important factor of a mature organisation is to make sure that that the software can support the collaboration data between each department. Therefore, it is not about the latest software that can make an organisation become mature, but the ability of the organisation to use the technology to fully support their activities.

On the fourth question about “set the supplier’s goal”, it has to be clear that there are different types of contracts, for example traditional contract, and performance contract. For every type of contract, suppliers must understand their goals. The definition of a mature organisation can be described as the successful maintenance goals and good

collaborations between the maintenance departments with the suppliers, clients, users, and stakeholders.

On the fifth question, to manage the resources of an organisation in a sustainable way, the ISO 14001 can be used. For the sixth question, the TCO/LCC is usually used by the asset manager or the real estate manager and not by the maintenance department. Therefore, the scope of this assessment sheet should be clearly set. On the seventh question, the criteria of a mature organisation can be added with the European law standard, that being followed by the maintenance departments for its policy and procurement procedures. On the eighth question, the definition of a mature organisation can be added to the use of external consultants to make good contracts. He argued that a professional consultant could enhance the quality of contracts because they have knowledge about what is important from the maintenance department's side and from the supplier's side.

In the third part of the assessment sheet, the enabler of "Leadership", it is also important to define to whom the leadership is meant to. The leadership of the asset management level will be different with the leadership of the facility management level. On the fourth question, a mature organisation can be defined as an organisation that involving suppliers to manage the change and flexibility in the organisation. This is the example case of the TU Eindhoven that involving suppliers to manage the process between the maintenance department and the suppliers. For the sixth question, it should be clear whether the sub aspect of human resources is part of the "Leadership" or part of the "People" of this assessment sheet.

The fourth part of this assessment sheet is "People" enabler. In this part it, the suppliers can be incorporated as the "People" factor. On the fourth question, a mature maintenance department should have good discussions, communication, and involving users, and the director of the organisation.

In the part of "Strategy" enabler, the definition of a mature organisation is a maintenance department that can manage the collaborations of the strategy of the whole organisation. For instance, the strategy of the Asset manager/Real estate manager and the head of maintenance department should be synchronised. In this part, it is also possible to add about the innovation strategy. By having a strategy to innovate, a maintenance department can improve their performances, to do more but less cost.

### *c. An expert from Building Service Installation Research Institute*

The expert from ISSO (Building installation research institute in the Netherlands) contributes his opinions in the second interview. This research institute has published several standards of building installations that can be used as guidelines for public and private institutions in maintaining their building installations. The guideline is, for example, the ISSO 101 that describes about maintenance contracts and specifications.

When the respondent was asked about the first part of the assessment sheet, he emphasises on the activities of the organisation in valuing the building assets. This term of building value here is related to its building's financial value. According to the respondent, mostly small organisations are not valuing the buildings. On the other hand, because of the building assets owned by the public organisations are too enormous, mostly they also do not value it.

On the second part of the assessment sheet, the respondent has opinions toward the distinctions of the levels that need to be clearer. On question four that discuss about the supplier's goals, the respondent argued that the criteria of a mature organisation as described at option d and e could be added with the cooperation between suppliers and clients. Furthermore, it is also important that the contracts should fit with the organisation. On question five, the concept of sustainability should align with the goals of the organisation. For question seven and eight that discuss about the procurement and

contractual model, it is important that the maintenance department discuss with the suppliers about their collaboration and follow the public organisation's regulations. On question eight, the researcher should evaluate on the level development, because according to the respondent, on level 1, a maintenance department should already have contractual models.

On the third part, the respondent implied that the multiple choices of the first question could be improved. Option b and c of the first question can be clearer. The definition of encouraging people in the organisation has no structured process. For question five, the definition of a mature organisation can be improved by involving clients and stakeholders in designing the vision and mission. By doing this, a maintenance department gives an opportunity to have an equal level with the stakeholders. Furthermore, it will create bonding between the maintenance department, the clients, and the stakeholders.

On the fourth part of the assessment sheet, the respondent discussed about the control system that is mentioned in the multiple choices of the question three. The definition of control systems and control the employees must be clear.

On the fifth part, the term of maintenance policy must be clear. For the first question, the definition of a mature organisation can be added with the ability of a maintenance department to have in-line strategies with the asset manager or the real estate manager.

From an overall interview, the respondent had several opinions and suggestions for the proposed assessment sheet. First, the development of the questions should avoid the questionnaire participant to be not objective. Therefore, it is better to add probing questions in the multiple choices. For example, if the participants are asked about the IT system, then the probing question can be "What types of IT system do you use to support your organisation?". By providing the probing question, the participants can clarify the maturity levels based on evidences, and not by their own confidences. The biased answers because of the subjectivity can be avoided by mentioning the evidences of their organisations.

The second suggestion is to add a question about stakeholder management. The question can be "Which roles do the stakeholder management in your organisation?" This question is implying to the importance of a maintenance department able to working and collaborate within the operational level and the strategic level.

## 6.2 Discussion about the assessment sheet

In this research the final product is the maturity model and the final assessment sheet. The design of the assessment sheet uses multiple choices as a method to reveal the maturity levels of maintenance departments. The first multiple-choice answer is indicating level 1. Followed by the next choice as level two and the last choice is level 5. The respondents who fill the sheets will get score 1 to 5. To score this assessment sheet, it will use the average value of the weighting (Sacu, 2010).

The reason why this assessment is designed using the multiple choices that are gradually increasing as the level goes up is to make the respondents aware about their organisation's maturity and start to think about professionalism in a maintenance department. Nevertheless, the design of the assessment sheet can affect the results of the maturity assessment. The design should be able to provide the respondents to do the self-assessment and self-check toward the maturity of their organisations.

## 6.3 Conclusion for this chapter

According to the interview, several results can be concluded. Firstly, the scope of the organisation can affect the type of questions and the future questionnaire participants. The questions should be clear whether it will assesses the Real estate manager or to assess

the Maintenance department. Furthermore, it has to be understandable that the operational level and the strategic level will have different results in filling the questionnaire.

The second result implies that it is necessary to include “the ability of a maintenance department to collaborate with clients and stakeholders” as maturity level criteria, as well as “the maintenance department’s strategies are in-line with the management strategies”. Additionally, the topics of stakeholder management, sustainability, and innovation can be included in the assessment sheet as new questions.

The third result is to make distinction questions between the building installations, building functional and technical because the scope of the organisation will make it different.

The fourth result is to make the terms in the questionnaire clearer, especially for the “Control in organisation”, and “Maintenance policy”. The fifth conclusion is to make the questions resulting in the more objective output by adding probing questions.

In general, the assessment sheet should be able to be used by all maintenance departments, despite of their organisational structural differences. Furthermore, the assessment sheet should be able to accommodate the respondents doing the self-assessment, to increase awareness toward their maturity levels, and to design the strategies to achieve the next level.

# RESULTS AND DISCUSSIONS

# 7

## CHAPTER 7

### RESEARCH RESULTS AND DISCUSSIONS

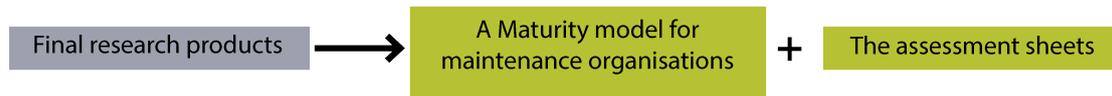


Figure 23 The final research step

In this chapter, the final results of this research are presented. After having two rounds of interviews, and designing the maturity model as well as the assessment sheet, the products are the final maturity model and the final assessment sheet.

#### 7.1 Change from proposed to final maturity model and assessment sheet

During the second round interview, several respondents provide feedbacks to the proposed assessment sheet. Therefore, the maturity levels are improved. The change is to make sure that the gradually increasing of the levels is clear.

There are also changes in the assessment sheet, because the assessment sheet has to be clear to be filled by the respondents. Several examples in the multiple choice answers are added to make sure that the respondents are understood when selecting the answers.

Table 37 The changing questions in the assessment sheet design

Maturity aspects	Question numbers and multiple answers that change or added
<b>Processes and services</b>	2a, 3a, 3d
<b>Partnerships and resources</b>	1d, 2c, 3d, 4e, 5b, 5c,7c, 8a, 8d
<b>Leadership</b>	1a, 1b,1c,1d, 3a, 3c,3d,3e,4a, 6b, 6d
<b>People</b>	1b, 1c,1d,2a, 3c, 3d, 4a, 4c, 4d
<b>Strategy</b>	1c, 1d, 2b, 2c, 2d, 4

There is an additional question in the assessment sheet added in the part of “Strategy” enabler. The fourth question is about the innovation strategy. This question is added to increase awareness to the maintenance department about the importance of thinking more innovative strategies that benefiting their organisation to be more effective and efficient, by using less costs and resources. Nevertheless, the sub aspects of “Strategy” in the maturity model have remained the same.

#### 7.2 The maturity model

Table 38 depicts the final maturity levels of the main aspects of the maintenance departments of public organisation. Maturity levels for the sub aspects are presented next. The main aspects of the maturity model are following the EFQM enablers. Yet, the sub aspects of the maturity model can be flexible and changing in the future, according to knowledge and technology development.

This maturity level table can be read vertically and horizontally. If it is read vertically, the state of the organisations of that level is described. Hence, if it is read horizontally, we can see the development level for each aspect. The maintenance

departments can use this to think about the current process in their organisations by reading it vertically, and plan for the future strategies by reading it horizontally.

**Table 38 The maturity model for maintenance departments of public organisation**

	Level 1 INITIAL	Level 2 REPEATABLE	Level 3 DEFINED	Level 4 MANAGED	Level 5 OPTIMISING
PROCESSES & SERVICES	There are no clear procedures for delivering maintenance services. The people work according to emerging needs. The organisation success is depending on individual performances.	There are basic standard procedures to deliver the maintenance process only for specific maintenance services. The organisation plans their maintenance services based on the previous project success. Project estimations are based on the expert knowledge.	The standard maintenance processes are consistent and integrated for most all maintenance services. The management can track the progress of their maintenance services. Projects estimations are based on their organisation standards.	Maintenance processes are integrated with their mission of organisation success. The management uses the data and involving stakeholders to make decisions.	Organisation evaluates their effectiveness and efficiency of delivering maintenance services. The goal is to improve their maintenance performances.
PARTNERSHIPS & RESOURCES	There are no clear procedures to manage partnerships and resources. Organisation matches their needs and resources available only when the maintenance services have to be delivered.	Recourses are documented to fit with the important maintenance processes/activities. The organisation establishes partnerships only with their important clients, suppliers, and stakeholders.	The organisation plans their resources to meet with the overall process. The organisation develops their partnerships with all of the clients, suppliers, and stakeholders.	Able to manage their resources to fit and support the success of entire organisation's activities. Partnerships with clients, suppliers, and stakeholders are well defined, and the organisation is seeking for innovation in the partnerships model.	Learns from strengths and weaknesses to improve partnerships and resources management.
LEADERSHIP	The leaders are having difficulty in establishing the vision and mission for the	The leaders set vision and mission. The leaders act as role models following the	The leaders are able to plan the processes, act as role models, and manage the	The leaders are able to act as role models, manage the strengths and competences	The leaders evaluate the organisation's strengths and weaknesses and improve it.

	people in the organisation. The organisation's leaders cannot become role models, and having difficulty to manage the maintenance processes. People are not encouraged to follow the organisation's value.	organisation's value. The leaders encourage people to apply their mission only for specific areas/ processes in organisations.	people in their organisation to apply organisation's mission for all processes and areas of the organisation.	of the organisation, and make sure that the value is in-line with the value of the management organisation.	
PEOPLE	People are important for the organisation, but the skills and competence of the people are difficult to recognised. The success of the organisation is depending on the individual effort.	The organisation develops procedures to recognise the skills and competences of people in their organisation. There is a career system development to improve the people competencies of specific/important areas in our organisation.	The organisation has consistent and standardised procedures to recognise and to manage the skills and competencies of their people. The organisation has a career development program for people of all areas of the organisation.	Make sure that the career system development is in-line with the success of organisation management.	The management of the people in the organisation is well integrated. The organisation evaluates the career development systems and seeking for improvement.
STRATEGY	The organisations have no planned strategy, but it will emerge when it is needed.	The organisation has clear strategies. Their strategy aims to control the primary process and the primary maintenance activities.	The organisation has standardised and consistent strategies. Their strategies are applicable to all processes and activities in their organisation.	The organisation's strategies are integrated and support the success of the organisation management. The organisation always innovates to seek the best strategies.	The organisation evaluates their strategies. The organisation knows their strengths and weaknesses and they improve it.

There are similar characteristic per level. For Initial level (level 1), the maintenance department has already set up basic processes or procedures, but they have not standardised it yet. For the Repeatable level (level 2), the organisation has the standardised procedures or processes only for important, specific, or visible areas. The Defined level (level 3) explains that the organisations already have the standardised and consistent

procedures for all areas. The fourth level is the Managed level that describes that the maintenance departments can have good collaborations with the clients, the stakeholders, and markets. Furthermore, in level 4 the maintenance departments can in line their activities with the organisation management's goals. For instance, if the maintenance department is under the facility management, then it means that the maintenance departments can in line their goals with the goals of the asset management or the real estate management. The Optimising level (level 5) is the ultimate level that the maintenance department has reached excellences and has started to evaluate their activities. In this level, the organisations will seek for better improvements in their procedures, processes and standards.

### 7.2.1 The Maturity Levels of Sub aspects

We will discuss the maturity levels of each sub aspect. The developments of the levels are gradually increasing similar to the maturity levels of the main aspects.

#### a. Processes and Services

**Table 39. The sub aspects of Maturity levels of Processes and services**

Sub Aspects	Level 1 INITIAL	Level 2 REPEATABLE	Level 3 DEFINED	Level 4 MANAGED	Level 5 OPTIMIZING
Object Valuation and Condition assessment	Do not have standards.	Use own standards.	Use national standard procedures (e.g. NEN 8021, NTA 8026, NEN 2767).	Integrated data, compile it, use, and share it with stakeholders and organisations Management.	Able to recognise strengths and weaknesses in performing valuation and assessment and focus on improvement.
Supervising Maintenance activities	Do not have clear procedures to supervise.	Supervise only visible/ Bigger projects.	Supervise all maintenance activities.	Involving suppliers in supervising. Have good collaborations and trust with suppliers.	Evaluate efficiency and effectiveness. Always seek for improvement.
Respond Client's feedback	Respond when problems are emerge.	Established feedback systems. (e.g. forms, questionnaires, etc.)	Use the standard systems consistently.	Use data from client's feedbacks to make decisions in organisation management.	Evaluate and review the feedbacks and response systems and improve it.

### b. Partnerships and resources

Table 40. The sub aspects of Maturity levels of Partnerships and resources

Sub Aspects	Level 1 INITIAL	Level 2 REPEATABLE	Level 3 DEFINED	Level 4 MANAGED	Level 5 OPTIMISING
Applying Technology	Use standard office software technology (e.g. Microsoft Office)	Use specific IT system to support maintenance process.	Use an integrated system for different departments in the organisation (e.g. FMIS).	Use of integrated systems in-line with the management of the whole organisation. Able to link it with suppliers and stakeholders.	Have integrated systems and evaluate its efficiency and effectiveness to seek improvement.
Manage collaboration with maintenance markets	Collaboration is managed within an ad hoc state.	Manage collaboration only with important/visible maintenance markets.	Able to manage collaboration with all maintenance markets.	Manage collaboration with all markets to support the organisation management.	Evaluate strengths and weakness in managing collaboration. Seeking improvement.
Setting the Supplier's goals	Set supplier's goals when they want to perform maintenance tasks.	Established the standard goals clearly stated in the contract only for visible/specific maintenance.	The standard goals clearly stated in the contract for all maintenance services.	Involving suppliers to design the goals and discuss with them. The goals in-line with the organisation management.	Evaluate and review supplier's goals in its efficiency and effectiveness. Seek for improvement.
Manage organisation's resources in a sustainable way	Manage the organisation's resource without thinking about its sustainability.	Establish procedures to manage the resource's sustainability only for specific areas.	Use standardised procedures (e.g. ISO 14001) to manage the resources in a sustainable way.	Manage the resources in a sustainable way to in-line with the goals of the organisation's management.	Have excellent resources management in a sustainable way. Evaluate the strengths and seeking improvement.
TCO/LCC	TCO/LCC is not used.	Use TCO/LCC only for specific contract (e.g. DBM contract) and specific area.	Use TCO/LCC for all maintenance services.	Use TCO/LCC for all maintenance activities and in-line with the goals of the management organisation.	Evaluate the efficiency and effectiveness of TCO/LCC in the organisation. Seeking improvement.
Procurement process and procedures	Perform procurement without clear standardised process and	Use procurement procedures for specific/visible/bigger	Use standardised and consistent procurement	Procurement procedures aim to in-line with the organisation	Review the strengths and weaknesses of the procurement

	procedures.	maintenance services.	procedures for all maintenance services.	management. Involving and discuss with clients, suppliers, and stakeholders to support the procurement process.	process and procedures. Focus on improvement.
Contractual model	Have contractual models, but not standardised.	Use standardised contractual models only for specific/visible maintenance activities.	Use standardised contractual models for all types of maintenance activities.	Contractual models are defined together with clients, suppliers and stakeholders to achieve the maintenance goals.	Have excellence contractual models for all maintenance services. Review and evaluate it, and focus on improvement.

### c. Leadership

Table 41. The sub aspects of Maturity levels of Leadership

Sub Aspects	Level 1 INITIAL	Level 2 REPEATABLE	Level 3 DEFINED	Level 4 MANAGED	Level 5 OPTIMISING
Continuously improving	Leaders do not set the plan for organisation's improvement	Leaders establish guidelines and plan to make sure that the organisation is always improving for specific/visible areas.	Leaders set clear strategies that consistent and standardised to improve organisations in all areas.	Leaders make sure that the organisation's improvement is in-line with the organisation management. Involving clients and stakeholder's opinions for improvement.	Leaders monitor and review organisation's plans for improvement. Always seek the most efficient and effective ways.
Encourage integrity, transparency, effectiveness, and legality rules	Leaders have difficulty in promoting integrity, transparency, and effectiveness because unclear legality rules.	Leaders have clear policies and legality rules toward transparency, integrity, and effectiveness only for maintenance processes.	Leaders have clear policies and legality rules toward transparency, integrity, and effectiveness of all maintenance processes and all areas in an organisation.	Leaders are involving clients, stakeholders, and suppliers to create the environment of transparency, integrity and effectiveness according to the legality rules.	The state of legality rules, transparency, integrity, and effectiveness in organisation are very well integrated and excellence.
Manage the change and flexibility	Leaders manage the change in the organisation	Leaders have clear guidance to manage the changes and	Leaders are able to manage the change and	Leaders are able to manage the change and	Leaders review and evaluate the change and

	when it is emerged and needed.	flexible for specific primary activities and areas.	flexibility through standardise and consistent strategies (e.g. PDCA (plan, do, check, act)) for all activities and areas.	flexibility to support the success of organisation management. Leaders involving clients, stakeholders, and suppliers to encourage the changing.	flexibility of the organisation. Always seek for improvement.
Mission and vision of the organisation	Leaders have difficulty in setting the vision and mission. People in the organisation cannot recognise what the mission and vision are.	Leaders are able to set the vision and deliver it in the form of mission only for specific/visible maintenance processes. People recognise it.	Leaders set the vision and mission for all aspects of the organisation and make sure that the people understand and apply it in the organisation.	Leaders set the vision and mission that support the success on all levels in organisation management. Leaders make sure that suppliers, clients, and stakeholders understand it.	Vision and mission are well integrated in management. Leaders review and improve it.
Developing human resources	Leaders develop human resources to match with the need. Competence and skills are not measured.	Leaders establish the systems (e.g. career path, course, training) to develop human resources, only for specific/visible areas.	Leaders establish the systems (e.g. career path, course, training), monitor the competences and skills to develop human resources, in all areas.	Leaders provide training for the people to support the success of an organisation's management. Encouragement from up and bottom level. The people's performances are measured and integrated with the career development.	Excellence procedures and process to develop human resources. Leaders evaluate it and always seek for improvement.

## d. People

Table 42. The sub aspects of Maturity levels of People

Sub Aspects	Level 1 INITIAL	Level 2 REPEATABLE	Level 3 DEFINED	Level 4 MANAGED	Level 5 OPTIMISING
Innovation and creativity	Less encouragement to be creative and innovative.	People are encouraged to be innovative and creative, mostly for the visible/bigger maintenance activities.	People are encouraged to be innovative and creative, for all aspects of the organisation.	People are encouraged to be creative and innovative for all processes to support the success of the integral organisation management.	Review and evaluate the output of the innovation and creativity. Always seeking for improvement.
Control in Organisation	Control in the organisation has no standards. Control the people when the crises are emerging.	Have procedures established (e.g. reward systems, monthly evaluation) to control the quality and competence of the people only for the visible/specific maintenance activities.	Control systems are integrated. People are responsible for their own products & qualities, more competitive, and able to adapt to the new ways of working that covers all levels and all maintenance activities.	Control systems aim to in-line with the success of organisation management. Evaluate employees to control their performance.	Have integrated systems to control the organisation. Evaluate control systems and focus on improvement.
Managing stakeholders	Stakeholder management at ad hoc state.	Have awareness and procedures established (e.g. weekly meeting, monthly meeting) to manage relationship with the main stakeholders.	Maintain the relationship with all stakeholders and understand their needs to control the quality of all maintenance activities.	Able to work together with stakeholders at operational level and strategic level to support the goals of the organisation management.	Evaluate the approach in managing stakeholders and seeking improvement for the most efficient and effective ways.

### e. Strategy

Table 43. The sub aspects of Maturity levels of Strategy

Sub Aspects	Level 1 INITIAL	Level 2 REPEATABLE	Level 3 DEFINED	Level 4 MANAGED	Level 5 OPTIMISING
Maintenance policy	There is no clear maintenance policy.	Maintenance policies available only for visible/primary maintenance strategies and processes. (e.g. only for planned preventive maintenance, only for new building).	Maintenance policies are consistent and standardised. It applied for all maintenance strategies and processes.	Maintenance policies are well defined, integrated. It has supported the organisation management. Maintenance policies are in line with the asset management strategies.	Evaluate maintenance policies. Always seek for improvement for the most effective and efficient policies.
Maintenance strategy	Less awareness towards the importance of different maintenance strategies (e.g. Planned preventive maintenance and Responsive maintenance)	Have maintenance strategies that are set for different types of maintenance services, only for the visible/primary scale of maintenance projects.	Have different strategies of Planned preventive maintenance and Responsive maintenance that cover all scales of maintenance.	Maintenance strategies aim to support organisation management.	Maintenance strategies are integrated with the management system. Evaluate the efficiency and the effectiveness and improve it.

### 7.3. The Assessment sheet

The final assessment sheet is presented below:

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## A MATURITY MODEL FOR BUILDING MAINTENANCE DEPARTMENTS OF PUBLIC SECTORS ASSESSMENT SHEET

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**Instruction:**

*This questionnaire will takes approximately 30 minutes to fill in. There are five parts of questions. Please choose only one answer that reflects with the current situation in your organisation the most.*

#### A. PROCESSES AND SERVICES

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1. How does your organisation manage maintenance processes and services?
  - a. We work according to emerging needs in our organisation. Our success depends on individual performances.
  - b. We have basic standard procedures to deliver the maintenance process only for specific maintenance services.

- c. We have standard maintenance processes that are consistent and integrated for most of all maintenance services.
  - d. We have maintenance processes that are integrated with our mission of organisation success. We involve stakeholders to make decisions.
  - e. We have processes to evaluate our effectiveness and efficiency of delivering maintenance services.
- 2. How does your organisation perform an object assessment?**  
*(Here, the object assessment is an assessment that is conducted to value the building objects /assets within the aspects of functional and financial. This question is referring to the strategic level of your organisation)*
- a. We don't have specific standards (e.g. accounting standard for building financial value, NEN 8021, NTA 826) for the assessment.
  - b. We use our own standards.
  - c. We use national standardised procedures.
  - d. We value the building objects, compile the data, and then we use and share it for all levels in our organisation management and for our stakeholders.
  - e. We recognise our strengths and weaknesses in valuing the building objects and learn from it.
- 3. How does your organisation perform a condition assessment?**  
*(Here, the condition assessment it is an assessment of the technical aspects of building components. This question is referring to the operational level of your organisation)*
- a. We don't have specific standards (e.g. NEN 2767, ISSO standard) for the assessment.
  - b. We use our own standardized procedures to value the building objects of which the bigger scale maintenance services will be performed.
  - c. We use national standardised procedures.
  - d. We value the building objects, compile the data, and then we use and share it for all levels in our organisation management and for our stakeholders.
  - e. We recognise our strengths and weaknesses in valuing the building objects and learn from it.
- 4. How does your organisation supervise the delivery of maintenance activities?**  
*(Here, supervising maintenance activities means that the organisation monitors the maintenance processes from the planning phase to the execution phase)*
- a. We supervise our maintenance process when it is needed and mostly initiated by individual effort.
  - b. We have our own standard procedures for supervising maintenance. We mostly supervise the visible/bigger maintenance activities.
  - c. We supervise all of the maintenance activities based on the standard procedures we have.
  - d. We supervise all of the maintenance activities and we involve suppliers to do it. We have good collaboration with suppliers and we trust them.
  - e. We evaluate our efficiency and effectiveness of our supervising activities.
- 5. How does your organisation respond to client's feedbacks?**
- a. We respond to feedbacks when it is emerges.
  - b. We have established systems (e.g. forms, questionnaires, online feedback, etc.) to respond the feedbacks from clients.
  - c. We are consistently using our standardised systems to response feedbacks from clients.
  - d. We use the data from client's feedbacks to make decisions in our organisation management. We also ask feedbacks from other stakeholders.
  - e. We evaluate our systems and our responses to client's feedbacks. We review its strengths and weaknesses.

## B. PARTNERSHIPS AND RESOURCES

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1. How does your organisation manage partnerships and resources of the organisation?
  - a. We match our needs and our available resources, only when the maintenance services have to be delivered.
  - b. We establish partnerships with our important clients, suppliers, and stakeholders.
  - c. We develop our partnership with all of the clients, suppliers, and stakeholders.
  - d. We are able to manage our partnerships and organisation's resources to fit and support the success of entire organisation's activities in maintenance.
  - e. We learn from our strengths and weaknesses to improve our partnerships and resources management.
2. How important is technology (e.g. IT system) for your organisation in providing maintenance services?
  - a. We use basic technology (e.g. Microsoft office) to support our maintenance processes.
  - b. We use a specific IT system to support the specific maintenance processes.
  - c. We use an integrated IT system between different departments in the organisation that supports all of our maintenance processes.
  - d. We use IT systems applicable for delivering maintenance services that are in line with the organisation's management systems. We are able to incorporate data from our clients, suppliers, and stakeholders and support our collaboration.
  - e. We have a very well integrated IT system and we evaluate its efficiency and effectiveness to seek improvement.
3. How does your organisation manage the collaboration with the maintenance markets?
  - a. We manage our collaboration with the maintenance market when it is needed.
  - b. We are engaged with the most important and visible maintenance markets and we are able to develop mutual collaboration.
  - c. We are able to manage our collaboration with most all of the maintenance markets. Our relationships are consistent.
  - d. We manage our collaboration with all maintenance markets to support the success of the management of our organisation. We are able to determine our goals by collaboration with maintenance markets.
  - e. We evaluate our strengths and weaknesses in managing our collaboration with the maintenance market and improve it.
4. How does your organisation set the supplier's goal to deliver maintenance services?
  - a. We set the supplier's goals immediately when they want to perform the maintenance tasks.
  - b. We have defined standard goals for the suppliers. The goals are clearly stated in the contract for specific/visible maintenance services.
  - c. We have consistent and standardised goals for the suppliers. The standard goals are integrated and clearly stated for all maintenance services.
  - d. We set the supplier's goals together with clients and suppliers. We set the supplier's goals that in line and integrated with the organisation's management goals.
  - e. We have well defined supplier's goals. There is good collaboration established between clients and suppliers. Therefore, we evaluate its efficiency and effectiveness of the goals.
5. How does your organisation manage the organisation's resources in sustainable ways?
  - a. We manage our resources, but we don't think that managing it in a sustainable way is necessary.
  - b. We have established procedures to manage our organisation resources in sustainable ways for specific area. We use our own procedures.
  - c. We have standardised and consistent procedures (e.g. ISO 14001) to manage our resources in sustainable ways for all areas of our organisation.
  - d. We manage our resources in sustainable ways that in-line with the goals of our

- organisation management. We are involving our partners, clients, and stakeholders to support it.
- e. We have excellent management of our resources that are integrated and organised. We evaluate the strengths and weaknesses, and seeking for improvement.
6. How does your organisation incorporate TCO/LCC in management level?
    - a. We don't think that the TCO/LCC is applicable to use in our organisation.
    - b. We use TCO/LCC only for appropriate contract (e.g. DBM contract) and specific circumstances.
    - c. We have standardised and consistent procedures to use TCO/LCC and implement it in all our maintenance services.
    - d. We use TCO/LCC for all our maintenance activities and make sure that it is in-line with the management of our organisation.
    - e. We evaluate the efficiency and effectiveness of using the TCO/LCC in our organisation; we learn from it and improve it.
  7. How do your organisation procure maintenance services?
    - a. We perform procurement, though we don't have a clear standardised process and procedures.
    - b. We establish procurement procedures for specific maintenance activities, for instance bigger/visible maintenance projects.
    - c. We have procurement process and procedures (e.g. European procurement Law) that are standardised and consistent for all types of maintenance services and projects.
    - d. Our decisions in procurement process are in-line with our organisation's management perspectives. We involve our clients, suppliers, and stakeholders to discuss and support our procurement processes.
    - e. We review our procurement processes and improve it to focus on its effectiveness and efficiency.
  8. How does your organisation apply contractual models for maintenance services and activities?
    - a. We have a contractual model for our maintenance activities, but we don't have clear standards.
    - b. We have standard contractual models for specifics/visible maintenance activities.
    - c. We have consistent and standardised contractual models for all types of maintenance activities.
    - d. We have contractual models that are defined together with our clients about what are the appropriate maintenance strategies that will be provided by us. We use professional consultants to develop our contracts.
    - e. We have excellent contractual models for different maintenance strategies; and we evaluate its strengths and the weaknesses. We always seek for improvement.

## C. LEADERSHIP

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1. How do you consider the Leadership in your organisation?
  - a. Our leaders cannot act and inspired people in the organisation to achieve the maintenance goals.
  - b. Our leaders are able to act as role models and encourage people to apply our maintenance goals only for a specific area (e.g. only for technical area).
  - c. Our leaders are able to plan our maintenance processes, act as role models, and manage the people in our organisation in all areas.
  - d. Our leaders are able to act as role model, encourage people to make sure that the maintenance goals and value is in-line with the value of our management organisation.
  - e. Our leaders evaluate our strengths and weaknesses and improve it.
2. How do the leaders of your organisation make sure that the organisation is continuously improving?
  - a. Our leaders do not set the plan for organisational improvement. Improvement in our

- organisation is based on individual effort.
- b. Our leaders establish guidelines and plan to make sure that our organisation to always improve only for the specific/visible areas.
  - c. Our leaders set clear strategies that consistent and standardised to improve our organisation in all areas.
  - d. Our leaders make sure that our improvement is in line with our organisation management. We are involving clients and stake holder's opinions in order for the improvement and innovation.
  - e. Our leaders monitor and review our organisation's plan for improvement. We always seek for the most effective and efficient improvement.
3. How do the leaders in your organisation encourage integrity, transparency, effectiveness and legality rules?
- a. Our leaders have difficulty in promoting integrity, transparency, and effectiveness in our organisation because of unclear legality rules. There are risks of fraud in our maintenance processes.
  - b. We have clear policies and legality rules toward transparency, integrity, and effectiveness only for our maintenance processes.
  - c. Our leaders bring the spirit of transparency, integrity and effectiveness in all processes and aspects of our organisation management.
  - d. Our leaders are working together with clients and stakeholders to create the environment of transparency, integrity, and effectiveness according to legality rules.
  - e. The state of legality rules, transparency, integrity, and effectiveness in our organisation are very well integrated and excellence.
4. How do the leaders in your organisation manage the change and flexibility?
- a. Our leaders manage the change in the organisation when it is emerged and needed. Our leaders have difficulty and inflexible when a new condition exists.
  - b. Our leaders have clear guidance to manage the changes and flexible for specific primary activities and areas.
  - c. Our leaders are able to manage the change and flexibility through standardise and consistent strategies (e.g. PDCA (plan, do, check, act)) for all activities and areas.
  - d. Our leaders make sure that our changes are supporting the success of our organisation management. We are flexible and involve partners, clients, and stakeholders to encourage positive changing.
  - e. Our management of change and flexibility are well integrated. Therefore, our leaders review the change and flexibility in our organisation and always seek for improvement.
5. How do the leaders in your organisation set the vision and mission, and incorporate people in delivering it?
- a. Our leaders have difficulty to set the vision and mission. The people in our organisation cannot recognise what the mission and vision are.
  - b. Our leaders are able to set the vision and deliver it in the form of mission for the specific/visible maintenance processes. People recognise it.
  - c. Our leaders set the vision and mission for all aspects of the organisation and make sure that the people understand and apply it into our organisation.
  - d. Our leader set the vision and mission that support the success on all levels in our organisation management. We involve suppliers in designing vision and mission. We make sure our clients and stakeholders understand it.
  - e. Our vision and mission are very well integrated in our management system. Our leaders review and improve it.
6. How do the leaders of your organisation developing the human resources?
- a. Our leaders develop human resources to match with the needs. We don't measure the competence and skills of the people in our organisation.
  - b. We have system established (e.g. career path, course, training) to develop the capabilities of our human resources. Our leaders focus on development for the employees on specific/visible areas.

- c. Our leaders set the procedures to develop human resources that are consistent and standardised. Our leaders focus on the development of skills and competence of the people of all areas.
- d. Our leaders provide training for the people in our organisation to support the success of an organisation's management. There are encouragement from up and bottom level. The people's performances are measured and integrated with the career development.
- e. We have excellence procedures and process to develop our human resources. Our leaders evaluate it and always seek for improvement.

## D. PEOPLE

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1. How does your organisation valuing the people?
  - a. People are important for our organisation, but the skills and competence of the people are difficult to recognised.
  - b. We have procedures to recognise the skills and competences of people. We develop a career system to improve the people competencies of specific/important areas in our organisation.
  - c. We are able to use our development systems to enhance the people competencies of all areas of our organisation.
  - d. We make sure that our career system development is in-line with the success of organisation management.
  - e. The management of the people in our organisation is well integrated. We evaluate the systems and seeking for improvement.
2. How does your organisation consider innovation and creativity?
  - a. We have less encouragement to be innovative and creative in our organisation.
  - b. We are encouraged to be innovative and creative, mostly for the visible/bigger maintenance activities.
  - c. We have standardised procedures that encourage innovation and creativity for all aspects and activities in our organisation.
  - d. We are encouraged to be creative and innovative for all processes that support the success of our integral organisation management.
  - e. We review and evaluate our output of the innovation and creativity. We are seeking for the innovations that bring the most efficient and effective processes.
3. How do you consider control in your organisation?  
(Control in organisation here means to monitor the performances of the people in the organisation)
  - a. We have an unclear system to control the skills and competence of the people and we use it only when a crisis happened in the organisation.
  - b. We have procedures established (e.g. reward systems, monthly evaluation) to control the quality and competence of the people only for the visible/specific maintenance activities.
  - c. Our control systems are integrated into our organisation. People are responsible for their own products & qualities, more competitive, and able to adapt to the new ways of working that covers all levels and all maintenance activities in our department.
  - d. Our control systems are aiming to in-line the maintenance department with the success of organisation management. We evaluate our employees to control their performances.
  - e. We have well integrated systems to control our organisation. We evaluate our control systems and improve it.
4. How does your organisation consider managing the stakeholders?
  - a. We manage our stakeholders when the problems are emerging.
  - b. We have awareness and procedures established (e.g. weekly meeting, monthly meeting) to manage our relationship with the main stakeholders.
  - c. We maintain the relationship with our stakeholders and understand their needs to control the quality of all maintenance activities.

- d. We are able to working together with stakeholders at operational level and strategic level in order to support the goals of the organisation management.
- e. We evaluate our approach in managing our stakeholders and seeking improvement for the most efficient and effective ways.

## E. STRATEGY

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1. How does your organisation considering strategy?
  - a. We have no planned strategy, but it will emerge when it is needed.
  - b. We have clear strategies in our organisation. Our strategy aims to control our primary process and our primary maintenance activities.
  - c. We have standardised and consistent strategies (e.g. ISSO 101). Our strategies are applicable to all processes and activities in our organisation.
  - d. Our strategies are integrated within the operational and strategic level, and support the success of our organisation management. We are always innovating to seek the best strategies.
  - e. We evaluate our strategy. We know our strengths and weaknesses and we improve it.
2. How does your organisation considering maintenance policy?
  - a. We don't have clear maintenance policies.
  - b. We have maintenance policies available only for visible/primary maintenance strategies and processes. (e.g. only for planned preventive maintenance, only for new building)
  - c. Our maintenance policies are consistent and standardised. It applied for all maintenance strategies and processes.
  - d. Our maintenance policies to support our maintenance strategies are well defined, integrated. Our maintenance policies support our organisation management.
  - e. We evaluate our maintenance policies. We always seek for improvement for the most effective and efficient policies.
3. How does your organisation considering maintenance strategy?
  - a. We have less awareness towards the importance of different maintenance strategies (e.g. planned preventive maintenance and responsive maintenance).
  - b. We have maintenance strategies that are set for different types of maintenance services, only for the visible/primary scale of maintenance projects.
  - c. Our different strategies of planned preventive maintenance and responsive maintenance cover all scales of maintenance.
  - d. The types of our maintenance strategies are aimed to support our organisation management.
  - e. Our maintenance strategies are integrated with the management system. We evaluate the efficiency and the effectiveness in order to improve it.
4. Does your organisation promote the innovative strategy?  
*(Innovative strategy here means that the organisation spend less costs for better results of maintenance strategies and more innovative maintenance processes)*
  - a. We are aware of innovative strategy, but we are not able to realise it.
  - b. We start to deliver innovative strategy only for visible maintenance projects and processes.
  - c. We have innovative strategies for every maintenance process in our organisation.
  - d. We have innovative strategies that aim to support our management organisation. We involve suppliers, clients, and stakeholders create more innovative strategies together.
  - e. We have innovative strategies and we evaluate its strengths and effectiveness. We always want to improve it.

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*This is the end of the questionnaire*

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## 7.4 How to use the final Maturity Model

The final Maturity model for maintenance departments of public organisations has an assessment sheet as complements. These two instruments are used together. Firstly, the maintenance departments can take the test by filling the assessment sheet.

Each question has five multiple choices, that will be scored from 1 to 5 according to the maturity levels. The final level score is summed up based on the average. Despite of the level scores, it is more essential that when the respondents answering the assessment sheet, they start to think about the topics that are exposed there. It is expected that after the respondents fill in the assessment sheet, they know what is the maturity levels of their organisation, and start to develop awareness, thought, and strategies toward the maturity main aspects and sub aspects.

Secondly, after scoring the results from the assessment sheet, the maintenance departments can review the maturity level tables. Despite the maturity levels already appeared in the assessment sheet, the maintenance departments can use this table to review its sub aspects by reading it horizontally and vertically. By reading the tables, the maintenance departments can reflect on their achievements and performances, whether it is concurrent with all aspects in the maturity levels, exceeding it, or less.

Finally, the maintenance departments could plan, whether they are willing to reach the next level, and what kind of strategies that they need. The maintenance departments could also add some aspects, or reduce sub aspects that maybe are not relevant to their organisations.

Again, this maturity model is a self-assessment tool that should help the maintenance departments to increase their performance and professionalism. Therefore, they can use it as guidance, and adjust its sub aspects and criteria when it is needed.

## 7.5. Discussion

The purpose of the maturity model and the assessment sheet is to create awareness and to make people of the maintenance departments of public organisations thinking about their process and activities. By using the assessment sheet described above, it is expected that the organisation can have a benchmark of maturity scores. Therefore, in this research, we only use the EFQM enablers as the key indicators.

According to Lindemulder (2015), a mature organisation can be assessed through the supported evidence and the rigorous processes. Further steps can be taken for the assessment in order to get results that are more objective. For example, by using the "Results" criteria of the EFQM model. This method can be time consuming, but the analysis can be more reliable because it assesses the results in organisations that applying the EFQM enablers in their processes. In addition, the EFQM model has more methods beyond the self-assessment. Lindemulder (2015) mentioned the assessment methods by using the EFQM model such as the EFQM Excellence matrix and the EFQM Site visit simulation. The advantages of using more advance methods are the more reliable results through evidence and a high process rigour.

The problem with the self-assessment sheet is it can create bias standard if the people who fill in the questionnaire do not have knowledge about their organisation. Respondents are intending to fill the questionnaire based on their experiences and expectations for their organisations. Nevertheless, the maturity model and the assessment sheet of this research can be used as a starting point where the maintenance departments begins to aware about their strengths, and are triggered to design their organisation's strategies to improve. By following the framework of the EFQM model, it will create more benefit for the organisation's assessment, because they can use the more comprehensive tools and not based on the opinions, but also on the results.

# CONCLUSIONS AND RECOMMENDATIONS

# 8

## CHAPTER 8

### CONCLUSIONS AND RECOMMENDATIONS

#### 8.1. Main findings

The main objectives of this research are to find the important aspects of a mature maintenance department and to develop a maturity model for maintenance departments of public organisation. To answer the main question of this research, which is ***“What are the important aspects of maintenance organisations can be used to develop a Maturity model for maintenance departments of public organisations?”*** we conduct literature reviews as the guidelines, and performing expert interviews to verify the proposed maturity model and the assessment sheet.

This research mainly focuses on answering this main research question. In chapter 2, we explain the results of the literature reviews. Furthermore, in chapter 3, we analyse those important aspects in maintenance organisations and link it with the reference models. In chapter 4 we describe the results of interviews with the experts to add more relevant opinions and feedbacks toward the important aspects that we found in chapter 2 and 3. The processes of exploring the important aspects of maintenance organisations continue in chapter 5 and 6. We confirm the relevancy of the proposed model by conducting second round interviews. The final results of the important aspects of maintenance organisations are then depicted in chapter 7 in the forms of a maturity model and an assessment sheet.

The important aspects of the maintenance organisations of this research are gathered from different perspectives of maintenance organisations, those are professional experts from private and public organisations. By exploring the knowledge from different perspectives, it can enrich and maximise the relevancy of the final maturity model.

#### 8.2 Sub Research Question 1

The sub question 1 is:

*“What are the important criteria of maintenance departments of public organisations?”*

- *What can be seen as important from the objectives, roles, tasks, and activities of maintenance departments of public organisations?*

In order to reveal the important aspects of the maintenance departments, we conduct literature reviews that focus on the activities of the maintenance departments. As the natures of public and private organisations are different, the literature reviews emphasis on the processes of delivering maintenance activities in public organisations. The differences between the private and public organisations are discovered on the procurement processes, the need of transparencies, the stakeholder relationships, and the collaborations. The answers of this sub research questions are described in chapter 2.

In chapter 3, the important criteria of maintenance departments in chapter 2 are then linked with the EFQM models and the reference maturity models. The results are the more concise maturity aspects. Therefore, these concise important aspects are developed as a proposed maturity model. To understand more about the important aspects of maintenance departments, the interview respondents provide their opinions toward this proposed model. Furthermore, their opinions also support the development of the maturity levels.

### 8.3 Sub Research Question 2

The sub research question 2 is:

*“What quality improvement tools can be adopted to measure the maturity levels of maintenance departments of public organisations?”*

- *What maturity models can be implemented to design a maturity model for maintenance departments of public organisations?*
- *How does the approach of the EFQM model for the organisations?*

The answers of these questions are explained in chapter 2. We explore several maturity models that can be used as references in this research. Hence, we use the Capability Maturity Model (CMM) and the Public Commissioning Maturity Model (PCMM) as the guidelines for the development of the maturity model. The approaches of the maturity models are explained in chapter 2. Furthermore, in designing the maturity levels we use the Project Management Maturity Model (PMMM) and the INK (Instituut Nederlandse Kwaliteit) to help identifying the levels development.

Beside the maturity models, we also review the EFQM model as a quality improvement tool that can be used by many types of organisations. The EFQM model has two criteria. First is the enabler and the second is the results factors. The explanation of the EFQM models is described in chapter 2. The concept of the EFQM model is a process flow that is started from the enablers. If an organisation implements the Enablers, it will achieve the Results. The process is then returned to the Enablers, to do a review of the previous process. The idea is to do recheck with the earlier processes and make sure that the quality improvement is continuous.

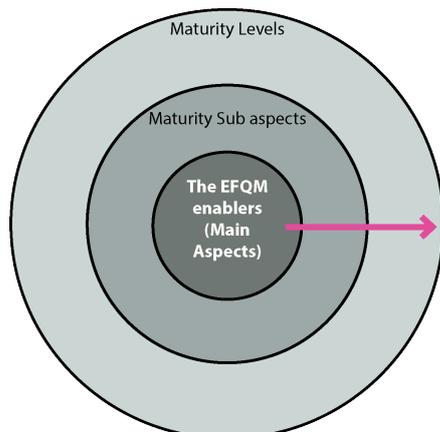
### 8.4 Sub Research Question 3

Sub research question 3 is:

*“How can the EFQM model, the maturity models, and the important criteria of maintenance department are related?”*

- *What components of the models and the important criteria can be used to design a Maturity model for maintenance departments of public organisations?*
- *How does the development of the maturity levels?*

These sub questions are answered in chapter 3 and 5. The EFQM model in this research is adopted by using its Enablers as the main maturity aspects for the maintenance



**Figure 24 Correlations between the EFQM enablers and Maturity aspects**

department's maturity model. These Enablers is the component of the EFQM model that can cover all aspects and areas of the maintenance departments. In this research, we categorised the maturity criteria of maintenance departments based on the EFQM enablers.

The position of the EFQM enablers is at the core of the maturity model development. These enablers are expanding into the maturity sub aspects. The maturity sub aspects are the development of the important criteria of the maintenance organisations. The maturity sub aspects are then developed into the maturity levels.

The outcomes of interviews with experts support the description of the maturity levels. Furthermore, to design the maturity levels we use the existing maturity models as guidance. From the

CMM (Capability Maturity Model), the basic depictions of the levels one to five are followed. From the PCMM (Public Commissioning Maturity Model) we can follow the maturity aspect definitions that are beneficial to portray the public organisation's activities, and the processes of developing the maturity model. As the PMMM (Project Management Maturity Model) levels become a reference, we can follow the levels development of this maturity model. In addition, we also use the interview results and the INK (the Netherlands quality institute) during the development of the maturity levels. Consequently, the maturity model for maintenance departments is a syntheses of several maturity models, quality improvement instruments, literatures, and experts' perspectives that attach to the EFQM enablers as the main core.

## 8.2. Thesis limitation

During this research, we realise that there is some limitation. Firstly, there is subjectivity of the researcher in understanding the literatures. When researching the key processes of maintenance departments, it is possible that not all of the important topics are covered. There is also a limitation toward literature available for the building maintenance departments in the public organisations area. Furthermore, the language barrier is a problem when reviewing the scientific journals, and important resources that is published in Dutch.

Secondly, in developing the maturity model, due to the time and available resources, only the EFQM enablers are used. The results factors of the EFQM model are not analysed. By using results factor, it can be revealed if the enablers are really resulting more positive development of the maturity level in an organisation. But to do so, we need to implement the enablers in maintenance departments, then analyse its results factors that might take some years. Furthermore, not all maintenance departments are willing to act as research samples for the EFQM implementation.

Thirdly, in this research there is no explanation towards how to develop the organisation from a certain level into a higher level. The limitation is due to time, different types of maintenance departments of public organisation and its organisational structures. Therefore, each organisation can design their plan and strategies to increase their maturity levels.

Finally, the limitation is about the subjectivity of interview respondents. When providing their opinions toward maturity sub aspects and maturity levels, the respondents can be biased with their own organisation state and their expectation. Furthermore, the availability of English speaking respondents and their fluency is limited.

In spite of these limitations, we believe that this Maturity model for maintenance departments is relevant as a self-assessment method to increase the awareness of professional in this field. Furthermore, it will increase the importance of maintenance departments as a valuable part of the public organisations body. We assume that the maintenance departments of public organisations, and other institutions that related to building maintenance can use this Maturity model and its assessment sheet.

## 8.3. Further research recommendations

For further research, it can be derived from the thesis limitation and the discussions of chapter 7. First of all, the types of public organisations and the maintenance departments in a specific area can be involved. It is also possible that the maturity model and the questionnaire are flexible and can be used by private sectors. The scope as explained in chapter 6.1 is important to develop the flexible questionnaire.

Secondly, it is possible to use the EFQM results variable in maturity model. Therefore, a framework can be developed to test and validate the maturity level position and then to measure the results of using the EFQM enablers.

The third recommendation is to test the validity of the maturity assessment sheet. Maintenance departments of public organisation can fill in the questionnaire and discuss the possible strategies to achieve the desired maturity levels. The strategies can be formulated so there are standards and guidelines to enhance the maturity levels for maintenance departments. Furthermore, the assessment developed in this research use multiple questions. There should be more improvement in the assessment sheet to derive more reliable results such as adding probing questions.

Finally, further research can use more comprehensive methods to reveal the maturity and develop strategies. As explained in chapter 7, the questionnaire developed in this thesis can only cover the state of the maturity level based on the opinion of the respondents. There should be more in depth assessment such as site visits to discover the evidences.

## 8.4 Reflection

This graduation research thesis is developed through many steps to reach the final results. At first, the aim of writing this thesis was to explore the elements that can enhance the professionalism of public organisations in managing their building assets. Nevertheless, the focus of the research must be narrowed into specific area. Therefore, the selection of research topic focused into maintenance departments as part of the public organisations. Maintenance departments have important roles in managing the public organisation's building assets. Thus, by having professional maintenance departments, public organisations can manage their assets in more effective and efficient ways.

The decision to develop a maturity model was influenced by the research of Prof. Marleen Hermans. As my mentor, I could use her developed maturity model, the Public Commissioning Maturity Model (PCMM) as my main reference to reveal the main aspects of Maintenance departments in Public organisations. Yet, during my P2 term I could not comprehend my research development with the PCMM as my main model. Therefore, I should change the main model reference with another model.

The development of PCMM was incorporating the EFQM model as a general model that commonly used in Europe as a quality management tool. Thus, we decided to use the EFQM model as my main reference to explore the maintenance maturity aspects. However, the PCMM was still become my reference to understand the factors that are important in public organisations. Furthermore, in journal literature of the PCMM, I could follow the step-by-step development processes of the maturity model for this research. Along with the PCMM, I also use the Capability Maturity Model (CMM) that developed by Paulk et.al (1993) as the reference to understand the basic idea of a maturity model.

The processes of revealing the criteria of mature maintenance departments were demanding. The literature reviews about maturity models for building maintenance were limited. I had to summarise and conclude the maturity aspects from the available resources and conducted expert interviews. My proposed maturity model consists of five main aspects and 20 sub aspects.

Finding the appropriate respondents was not easy. Some difficulties were related to the language barrier, the position of the respondents in the organisations, and the types of the company or organisations. Yet, I could manage to interviewed nine respondents from different types of maintenance organisations. The results from the interviews could enhance my knowledge about the maintenance department's activities in real professional situations. Furthermore, it helped me to develop the maturity level descriptions.

Developing the maturity levels was the most challenging part in this research. I did not find many scientific references as guidance about designing the maturity levels. I revised the descriptions several times after receiving feedbacks from my mentors, interview respondents, and after reading journals literatures. I also reviewed the development of maturity levels of Project Management Maturity Model (PMMM).

Therefore, I could build the final maturity levels. However, those level descriptions were changed again after the second round interviews.

There were no major changes in the proposed maturity aspects to the final maturity model. The change was on the descriptions of first sub aspect from “performing object valuations” into “object valuation and condition assessment”. The addition of condition assessment into the first sub aspect was because of object valuations assessing more on financial and functions, whether the condition assessment more on the physical aspect. Nevertheless, object valuation and condition assessment have the same purpose, which is to value the building assets. More changes were in the maturity level descriptions and the assessment sheet. The proposed assessment sheet was consisted of 26 questions and expanded into 27 questions. As is described in chapter 7 of this thesis report, the final maturity model consists of 5 main aspects and 20 sub aspects with five level descriptions for each aspect. The assessment sheet consists of 27 questions with 5 multiple answers for each question.

The purpose of developing the assessment sheet and the maturity model in this research is to make the maintenance departments able to do self-measurement to reveal their maturity. Once the maintenance departments aware about their current level, they can define their strategies and plan for the future improvement by exploring the maturity model.

The lesson learned from doing this research is that I need to be more focus and specific towards my thesis topic since the early phase of my research. I have to change my research questions for several times, that makes me understand that this research is a dynamic process. I also learn to manage my time and manage to interview the professional experts. Furthermore, I get more knowledge and an overview about the real professional works of maintenance in the Netherlands.

Finally, I feel satisfied through the journey of delivering this graduation thesis report. I had so many experiences that enhance my knowledge about the maintenance departments in public and private sectors, especially in the Netherlands. I also hope that this research will contribute in the development of science and knowledge to the management of the built environment area.

## Bibliography

- Allen, D. (1993). What is Building Maintenance? *Facilities*, 11 (3), 7-12.
- Alner, G. R., & Fellows, R. F. (1990). Maintenance of local authority school building in UK: a case study . *Proceedings of the International Symposium on Property Maintenance Management and Modernisation*, (p. 90). Singapore.
- April, A., Hayes, J. H., Abran, A., & Dumke, R. (2004). Software Maintenance Maturity Model (SMmm): The software maintenance process model. *Journal Software Maintenance and Evolution* .
- Australian Public Service Commision. (2012). *State of Service 2012 - 13*.
- Bamber, C. J., Sharp, J. M., & Castka, P. (2004). Third Party assessment: the role of the maintenace function in an integrated management system. *Journal of Quality in Maintenance Engineering* , 10, 26-36.
- Bamber, C., Sharp, J., & Hides, M. (2002). The role of the maintenance organisation in an integrated management system. *Managerial Auditing Journal* , 20-25.
- British Standards Institution. (1993). BS 3811: 1993. *Glossary of terms used in terotechnology* . London.
- Central Government Real Estate Agency. (2014). *Organisation*. Retrieved December 12, 2014 from Rijkvastgoedbedrijf: <http://www.rijkvastgoedbedrijf.nl/english/about-us/organisation>
- Chanter, B., & Swallow, P. (1996). *Building Maintenance Management*. Oxford: Blackwell Science Ltd.
- Chimi, C. J., & Russell, D. L. (2009). The Likert Scale: A Proposal for Improvement Using Quasi-Continuous Variables. *ISECON* . 26. Washington DC: EDSIG.
- Crawford, J. K. (2006). The Project Management Maturity Model. *Information Systems Management* , 23 (4), 50-58.
- Dunn, S. (2003). *www.plant-maintenance.com*. Retrieved December 7, 2014 from The fourth generation of maintenance: [http://www.plant-maintenance.com/articles/4th\\_Generation\\_Maintenance.pdf](http://www.plant-maintenance.com/articles/4th_Generation_Maintenance.pdf)
- EFQM. (n.d.). *EFQM model*. Retrieved November 2014 from EFQM: <http://www.efqm.org/>
- EFQM. (2012). *EFQM model*. Retrieved November 2014 from EFQM: <http://www.efqm.org/>
- EFQM. (2012). *EFQM model in action*. Retrieved 2014 from EFQM: <http://www.efqm.org/efqm-model/efqm-model-in-action-0>
- EFQM. (2012). *Leadership*. Retrieved 2015 from EFQM: <http://www.efqm.com/efqm-model/efqm-model-in-action/leadership>
- Gemeente Delft. (2015). *Organisatiestructuur*. Retrieved 2014 from Inwoners: [http://www.delft.nl/Inwoners/Gemeente\\_en\\_democratie/Organisatie/Organisatiestructuur](http://www.delft.nl/Inwoners/Gemeente_en_democratie/Organisatie/Organisatiestructuur)
- Ha, S. H., & Lee, M. J. (2010). Customer service quality improvement in the public sector through the Internet. *Total Quality Management* , 21 (11), 1161-1176.
- Haroun, A. E., & Duffuaa, S. O. (2009). Maintenance Organization. In M. Ben-Daya, D. S.O., R. A., J. Knezevic, & D. Ait-Kadi, *Handbook of maintenance management and engineering* (pp. 479-498). London: Springer.
- Hermans, M., Volker, L., & Eisma, P. (2014). A Public Commissioning Maturity Model for Construction Clients.
- Holmes, S. J., & Walsh, R. T. (2005, January 17). *Conducting Effective Project Management Maturity Assessment Interviews*. Retrieved 2015 from IMSI Integrated Management Systems, Inc: [http://www.imsi-pm.com/home/library/conducting\\_assessment.pdf](http://www.imsi-pm.com/home/library/conducting_assessment.pdf)
- Horner, R., El-Haram, M., & Munns, A. (1997). Building maintenance strategy: a new management approach. *Journal of Quality in Maintenance Engineering* , 3 (4), 273-280.
- Kans, M. (2008). An approach for determining the requirements of computerised maintenance management systems. *Computers in Industry* , 59, 32-40.
- Lai, A. W., & Pang, P. S. (2010). Measuring Performance for Building Maintenance Providers. *Journal of Construction Engineering and Management* , 136 (8), 864-876.

- Lau, W. K., & Ho, D. C. (2010). Facilities Management for Building Maintainability: A Research Framework. *CIB W070 International Conference in Facilities Management* (pp. 655-670). Sao Paulo: CIB W070.
- Lee, H. H., & Scott, D. (2009). Overview of maintenance strategy, acceptable maintenance standard and resources from a building maintenance operation perspective. *Journal of Building Appraisal*, 4 (4), 269-278.
- Lind, H., & Muyingo, H. (2011). Building Maintenance Strategies. *Planning Under Uncertainty*, 15-17.
- Lindemulder, M. (2015). Development of a Continuous Improvement Maturity Model Assessment Instrument. *5th IBA Bachelor Thesis Conference*. Enschede: University of Twente.
- Meng, X., Sun, M., & Jones, M. (2011). Maturity Model for Supply Chain Relationships in Construction. *Journal of Management in Engineering*, 27 (2), 97-105.
- Mossel, J. H. (2008). *The purchasing of maintenance service delivery in the Dutch social housing sector*. Delft: TU Delft.
- Nesensohn, C., Bryde, D. J., Fearon, D. J., & Ochieng, E. G. (2013). Combining Lean Construction With Maturity Models. *Procs 29th Annual ARCOM Conference*, (pp. 893-902). Reading.
- Paulk, M. C., Curtis, B., Chrissis, M. B., & Weber, C. V. (1993). *Capability Maturity Model for Software*. Pittsburgh, Pennsylvania, USA: Carnegie Mellon University.
- Pitt, M., Goyal, S., & Sapri, M. (2006). Innovation in facilities maintenance management. *Building Service Engineering Research and Technology*, 27 (2), 153-164.
- PRO INNO EUROPE. (2012). *EASME, Executive Agency for SMEs*. Retrieved february 2015 from European Commission: <http://ec.europa.eu/easme/sites/easme-site/files/Paper-EFQM-framework-Innovation-Agencies.pdf>
- Robert Walsh, S. H. (2005, January 17). *IMSI Papers*. Retrieved June 7, 2015 from Integrated Management Systems, Inc. (IMSI): [http://www.imsi-pm.com/home/library/conducting\\_assessment.pdf](http://www.imsi-pm.com/home/library/conducting_assessment.pdf)
- Söderholm, P., Holmgren, M., & Klefsjö, B. (2007). A process view of maintenance and its stakeholders. *Journal of Quality in Maintenance Engineering*, 13 (1), 19-32.
- Sacu, C. (2010, August). DWCM: The Data Warehouse Capability Maturity Model. *Thesis for the Degree of Master of Science*. Utrecht, The Netherlands: Utrecht University.
- Sapciay, Z., Wilkinson, S., & Costello, S. (2013). The Characteristics of Public Real Estate Asset Management and Maintenance Practice in New Zealand Council Community Buildings. *Facilities Management and Maintenance* (pp. 124-135). Brisbane: CIB Publication 385.
- Saranga, H. (2002). Relevant condition-parameter strategy for an effective condition-based maintenance. *Journal of Quality in Maintenance Engineering*, 8 (1), 92-105.
- Schmidt, M. (2014, 12 22). *Total Cost of Ownership TCO Explained: Definitions, Meaning, and Example Calculations*. Retrieved 12 23, 2014 from Building the Business Case: <https://www.business-case-analysis.com/total-cost-of-ownership.html>
- Schuh, G., Lorenz, B., Winter, C. P., & Gudergan, G. (2009). The house of Maintenance- Identifying the Potential for Improvement in Internal Maintenance Organisations by Means of a Capability Maturity Model. *The 4th World Congress on Engineering Asset Management*, (pp. 15-24). Athens.
- Spikin, I. J. (2013). *Developing A Risk Management Maturity Model, A comprehensive risk maturity model for dutch municipalities*. Twente, The Netherlands: University of Twente.
- Stanford, H. W. (2010). *Effective building maintenance: protection of capital assets*. Lilburn: The Fairmont Press, Inc.
- Straub, A. (2010). Competences of maintenance service suppliers servicing end-customers. *Construction Management and Economics*, 28, 1187-1195.
- Straub, A. (2012). Maintenance and Repair. *International Encyclopedia of Housing and Home*, 4, 186-194.
- Straub, A. (2011). Maintenance contractors acting as service innovators. *Construction Innovation*, 11 (2), 179-189.

- Straub, A. (2011, November 18). Maintenance Management. *Lecture Presentation for Real Estate Management Course*. Delft, The Netherlands: TU Delft.
- Straub, A. (2007). Performance-based maintenance partnering: A promising concept. *Journal of Facilities Management*, 5 (2), 129-142.
- Strukton. (2012). *About us*. Retrieved May 13, 2015 from Strukton: <http://www.strukton.com/about-us/>
- The Institute of Asset Management. (2014, July). *An anatomy of asset management*. Retrieved 2014 from <https://theiam.org/>
- Tsang, A. H. (2002). Strategic dimensions of maintenance management. *Journal of Quality in Maintenance Engineering*, 8 (1), 7-39.
- Tsang, A. H., Jardine, A. K., & Kolodny, H. (1999). Measuring maintenance performance: a holistic approach. *International Journal of Operations & Production Management*, 19 (7), 691-715.
- Velde, J. v., Klatter, L., & Bakker, J. (2013). A holistic approach to asset management in the Netherlands. *Structure and Infrastructure Engineering*, 9 (4), 340-348.
- Vukomanovic, M., Radujkovic, M., & Nahod, M. M. (2014). EFQM excellence model as the TQM model of the construction industry of southeastern Europe. *Journal of Civil Engineering and Management*, 20 (1), 70-81.
- Williamson, A., Williams, C., & Gameson, R. (n.d.). The Consideration of Maintenance Issues During the Design Process in the UK Public Sector.
- Williamson, A., Williams, C., & Gameson, R. (2010). The Consideration of Maintenance Issues During the Design Process in the UK Public Sector. *Egbu, C. (Ed) Procs 26th Annual ACROM Conference*, (pp. 1091-1100). Leeds.

## APPENDICES

### APPENDIX I

#### Interview protocols

- A. First I want to know your opinion about **important factors of a mature maintenance department**. What do you think those factors are? Can you mention **5 most important elements of mature** or professional maintenance department?
- B. **The 5 enablers of EFQM, would you also consider is as important elements as well?**

1.	The organisation should improve the processes and services to increase the value of stakeholders and customers.
Q:	In your opinion do Processes and services are important element of mature maintenance department?
2.	Excellence organisations ensure that they can manage the environmental and social impact. Partnership means a working relationship between the different parties in order to create added value for the customer (EFQM, 2012). Resources are any devices or systems that can help organisations to improve activities, such as financial resources, buildings, equipment etc.
Q:	Do you think Partnership and resources is important factor for mature maintenance department?
3.	The maintenance department requires good leadership as one factor that can bring an organisation to reach Excellency.
Q:	Do you think Leadership is important for mature maintenance department? If so why? Will it be different for different maintenance strategies (planned preventive maintenance and reactive maintenance)?
4.	People are essential as main resources that generate the power and performances of an organisation. People in organisation are all of the people involved in the organisation, such as employees, management team and also the leaders. Professional human resources can bring your organisation into success.
Q:	Do you think that People factor is important for mature organisations?
5.	The strategy is a tool to implement the vision and mission of the organisation in order to reach Excellency.
Q:	Do you think Strategy is important for maintenance department maturity? If so then why? If don't then why? What are the differences between the planned preventive maintenance and reactive maintenance?

- C. Now I have sub aspects of those five enablers. Therefore I will ask you with several questions below:

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### Processes & Services

#### *First Enablers*

1. Object valuation is the first step before performing maintenance activities. This means that the building object is assessed on its physical aspects. Thus, the maintenance strategies can be derived based on the assessment results.  
**Q:** In your opinion, is Performing object valuation can be a valuable factor of mature maintenance department? If yes/no why? Will this factor be different for the Planned preventive maintenance and Responsive maintenance?
2. During the execution of maintenance services, the maintenance department may perform project supervising to control the quality of the maintenance works.  
**Q:** Do you think Supervising maintenance activities is an important aspect of mature maintenance department?
3. Feedback from clients can give insight for the maintenance service improvement of the organisation. After performing maintenance services, the clients can provide the maintenance department with their feedback.  
**Q:** Do you think that Responding client's feedback is an important factor of mature maintenance department? If so why? Will it be different for different types of maintenance strategies (planned preventive maintenance and reactive maintenance)?
4. Do you want to add more important criteria about process, procedures and services of the mature maintenance department?

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### Partnership and Resources

#### *Second Enablers*

1. Implementing technology in maintenance department such as using computer software can help organisations perform works more efficient and effective.  
**Q:** Does Applying technology is a valuable element in mature maintenance department? If so why? Will it be different for both maintenance strategies (planned preventive maintenance and reactive maintenance)?
2. Maintenance markets are fragmented. They have different types of work, for instance installation maintenance (HVAC, plumbing); finishing maintenance (painting, ceramic tiles); and structural maintenance. Manage those different markets can make the process of maintenance activities more effective and efficient.  
**Q:** Do you think Manage the collaboration with the maintenance market is an important factor of mature maintenance department? Will this collaboration be different for different maintenance strategies (planned preventive maintenance and reactive maintenance)?
3. Maintenance department setting the supplier's goals to get the best value of maintenance works provided by the supplier. The selection criteria of suppliers can be decided in advance.  
**Q:** Does Setting the supplier's goal is a valuable aspect of mature maintenance department? If yes why? Are the selection criteria of suppliers can be different for both types of maintenance strategies (planned preventive maintenance and reactive maintenance)?
4. The maintenance department possesses resources that can be used for their maintenance activities. Resources can be building assets, materials, equipment, etc.  
**Q:** Do you think it is important factor of mature maintenance department that the maintenance department Manage the resources of the organisation in a sustainable way? If

so why? Will It be different for both maintenance strategies (planned preventive maintenance and reactive maintenance)?

**5.** TCO (Total Cost of Ownership) is an analysis tool to discover the overall of lifetime costs that follow from owning a certain building assets (Schmidt, 2014). Maintenance cost is one of the TCO components. By reducing the maintenance costs through choosing the best maintenance strategies, public organisations can lower their TCO.

**Q:** Does Incorporating TCO in accounting calculation is an important aspect of mature maintenance department? If so why?

**6.** The selection of preferred maintenance suppliers is done as part of the procurement process. As the maintenance department is part of the public organisation, the procurement types and the contractual types should follow the rules and legislation, within procedures.

**Q:** Do you think that Procurement process and procedures is an important factor of mature maintenance department? If yes/no why? Will this be different for both maintenance strategies Planned preventive maintenance and Responsive maintenance?

**7.** There are many contracts that can be used for maintenance activities, such as traditional contracts, all-in contracts, and performance-based contracts.

**Q:** Do you think that Having appropriate contractual model for planned maintenance and responsive maintenance is an important aspect of mature maintenance department? If so why?

**8.** Do you want to add more important factor about partnership and resources of mature maintenance department?

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## Leadership

### *Third enablers*

**1.** Continuously improving organisation means that an organisation always wants to develop their professionalism in performing the tasks and services.

**Q:** Do you think Continuously improving is important for a mature maintenance department? If so why?

**2.** Transparency in public organisation is often related to the accountability. A transparent public organisation allows for the distribution of information. Integrity is the quality of being honest and having strong moral principles.

**Q:** Do you think Transparency and integrity are important for a mature maintenance department? If so why? Will it be different for different maintenance strategies (Planned preventive maintenance and Responsive maintenance)?

**3.** Changing in an organisation means that the organisation adapting to the new challenge coming from the environment, stakeholders, or people. Flexibility in an organisation is the ability to adapt with the new situation to solve problems.

**Q:** Do you think Manage the change and flexibility is a valuable criteria for a mature maintenance department? If yes/ no why? Will this be different for different strategies (Planned preventive maintenance and Responsive maintenance)?

**4.** Mission and vision of organisation is a set of goals and values of the organisation.

**Q:** Do you think Set the mission and vision of the organisation, and incorporate the people in the organisation in doing it, is an important element for a mature maintenance department? If so why? Will it be different for different maintenance strategies (Planned preventive maintenance and Responsive maintenance)?

**5.** Legality rules of the maintenance department incorporate every aspect. In public organisation the legality rules are often related to the procurement, contract, and

procedures for delivering maintenance services.

**Q:** Do you think it is a valuable criterion of mature maintenance department that Leader can tackle the legality rules?

**6.** Human resources development means that organisation increase the ability of its people through providing training.

**Q:** Do you think Developing human resources is valuable for the mature maintenance department? If so why?

**7.** Is there anything you want to add the criteria related to leadership in mature maintenance department?

## People

### *Fourth enablers*

**1.** A professional organisation is often encouraged by the innovation and creativity of the people.

**Q:** Do you think Innovation and creativity is an important criteria or indicator for the maturity of maintenance department? If yes/ no why? What is the impact for different maintenance strategies (Planned preventive maintenance and Responsive maintenance)?

**2.** Control in the organisation means that the organisation can supervise the activities of the people toward their works, productivity, or quality of their services. Organisation rewards the people according to their results and performances.

**Q:** Do you think that Control in organisation is important for mature maintenance departments?

**3.** The stakeholders of the maintenance department are clients, public organisations, end-users, maintenance suppliers, and also internal clients. Managing stakeholders means that the process of organisation to maintain the supports of stakeholders for strategies, projects, or change within organisation.

**Q:** Do you think Managing stakeholder is valuable for a mature maintenance department? If yes/no why? Is this affecting the different maintenance strategies (Planned preventive maintenance and Responsive maintenance)?

**4.** Are there any other important elements toward human resources/people criteria that are not covered yet in my maturity aspects?

## Strategy

### *Fifth enablers*

**1.** Maintenance policy can give guidance for the people in maintenance department in delivering their services.

**Q:** Do you think Maintenance policy is valuable for mature maintenance department? Will the maintenance policy be different for Planned preventive maintenance and Responsive maintenance?

**2.** Do you have any other important factors in mature organisation that I have not mentioned yet?

D. The table below is my proposed maturity model for maintenance department. **What is your opinion toward the maturity levels of each sub aspects? Would you add some definition for the maturity levels?**

PROPOSED MATURITY MODEL		
EFQM ASPECTS	SUB ASPECTS	MATURITY LEVELS DEFINITION
1 <b>Processes &amp; Services</b>	Performing object valuation	<p><b>Highest level:</b> Organisation performing objects valuation as a first step of planning maintenance. This step allow organisation to assess the critical level of maintenance needed for building object.</p> <p><b>Lowest level:</b> Organisation does not perform object valuation. The maintenance works are carried based on estimation.</p>
	Supervising maintenance activities	<p><b>Highest level:</b> Organisation supervises the maintenance projects and make sure the results is satisfying the client's goals.</p> <p><b>Lowest level:</b> Organisation does not supervise the maintenance activities, or the work supervising is still chaotic.</p>
	Responding client's feedback	<p><b>Highest level:</b> Organisation already has a system to cope with the feedback from the clients. All of the feedbacks are responded well.</p> <p><b>Lowest level:</b> Organisation does not have any system to cope with the client's feedback. The responses from clients are handled without good follow up.</p>
2 <b>Partnership &amp; Resources</b>	Applying technology	<p><b>Highest level:</b> Organisation maximising the potential of technology for the activities in their organisation that can increase their productivities and process development.</p> <p><b>Lowest level:</b> Organisation does not applying technology for their process and productivities. The technology used is standard types for the office works.</p>
	Manage the collaboration with the maintenance market	<p><b>Highest level:</b> Organisation build partnership with suppliers and clients based on mutual trust, respect and openness, to make sure that the process and works are in line with the organisation's strategies and values.</p> <p><b>Lowest level:</b> Organisation does not build relationships with suppliers and clients.</p>
	Setting the supplier's goal	<p><b>Highest level:</b> Organisation set the supplier's goals that align with the client's expectation to make the results of the maintenance activities clear and achieve the best results.</p>

		<p><b>Lowest level:</b> Organisation does not setting the supplier's goals, the outcome of the maintenance projects can be different to the client's goals.</p>
	Manage the resources of the organisation in a sustainable way	<p><b>Highest level:</b> The organisation can manage their assets very well and organised. Organisation concern about the sustainability of their resources.</p> <p><b>Lowest level:</b> Organisation cannot manage their assets and does not incorporate sustainability in the management.</p>
	TCO/LCC	<p><b>Highest level:</b> Organisation incorporating TCO/LCC in their accounting/ financial report.</p> <p><b>Lowest level:</b> Organisation does not implement or consider toward TCO/LCC in their financial/ accounting.</p>
	Procurement process and procedures	<p><b>Highest level:</b> Organisations following the process and regulation by the policy maker toward maintenance procedures and process for public organisation.</p> <p><b>Lowest level:</b> Organisation does not have and follow procurement standard.</p>
	Appropriate contractual model	<p><b>Highest level:</b> Organisation set contractual model for different maintenance strategies such as planned preventive maintenance and responsive maintenance.</p> <p><b>Lowest level:</b> Organisation does not set contractual model for different maintenance strategies.</p>
<b>3</b>	<b>Leadership</b>	
	Continuously improving	<p><b>Highest level:</b> Leader design, monitor, review and drive the improvement of the organisation's management system and performance. Thus will make sure that the organisation is continuously improving.</p> <p><b>Lowest level:</b> Leader of the organisation does not have any plan to improve organisation capabilities.</p>
	Encourage integrity, transparency, effectiveness, and legality rules	<p><b>Highest level:</b> Transparent organisation; people are having integrity; legality rules are set clearly; encourage effectiveness in the organisation. The leader can incorporate all of the aspects needed for the organisation's development.</p> <p><b>Lowest level:</b></p>

		<p>The management of the organisation is not transparent. There is no encouragement for integrity. There are no clear legality rules. The organisation does not encourage effectiveness of working.</p>
	Manage the change & flexibility	<p><b>Highest level:</b> Effective to manage the change through focus on improvement and flexible, which is, able to make decision in organisation based on available information that focus on process improvement.</p> <p><b>Lowest level:</b> Organisation is not ready for the changing and do not have any instrument to cope with the new development.</p>
	Set the mission and vision of the organisation, and incorporate the people of the organisation in doing it	<p><b>Highest level:</b> Organisations have clear vision and mission, and have strategies to achieve it. Leader develops the goals of the organisation and make sure that the goal is achieved.</p> <p><b>Lowest level:</b> There is no organisation's vision and mission, or the vision and mission are not clear. There are no strategies to achieve the organisation's goal.</p>
	Developing human resources	<p><b>Highest level:</b> Skills and competence of the people in the organisation are recognised and developed.</p> <p><b>Lowest level:</b> The people are not encouraged for improving their competences.</p>
<b>4</b>	<b>People</b>	
	Innovation & creativity	<p><b>Highest level:</b> Organisation recognise that innovation can apply to process in the organisation. Creativity is encouraged as a part of the culture in the organisation.</p> <p><b>Lowest level:</b> Organisation does not promote innovation in the organisation. Creativity is not assembled in the organisation's culture.</p>
	Control in organisation	<p><b>Highest level:</b> Organisation recognised the people skills and competence. Their supports and effectiveness for organisation are awarded. Their activities are monitored to make sure that they are cared and increase their productivity.</p> <p><b>Lowest level:</b> Organisation does not monitor the people's activities. There is no reward system.</p>
	Managing stakeholders	<p><b>Highest level:</b> Organisation is ensured that stakeholders are treated well in order to achieve their common goals. Organisation can understand their position between the stakeholders. Organisation can understand the aim of the stakeholders</p>

		and try to satisfy the stakeholders.  <b>Lowest level:</b> Organisation ignores the important of managing their relationship with the stakeholders.
<b>5 Strategy</b>	Maintenance policy	<b>Highest level:</b> Organisation having maintenance policy that can be followed when performing maintenance activities.  <b>Lowest level:</b> Organisation does not have maintenance policy.
	Maintenance strategy (Planned Preventive maintenance and Responsive maintenance)	<b>Highest level:</b> Organisation can perform professionally the strategy of planned preventive maintenance and responsive maintenance.  <b>Lowest level:</b> Organisation does not have maintenance strategies of planned preventive maintenance and responsive maintenance.

E. In general, **do you have another important elements** that I should incorporate in my maturity model? Are there any other things that I should consider?

## APPENDIX II

Questions	GEMEENTE DELFT	GEMEENTE ROTTERDAM	FMVG TU EINDHOVEN	FMVG TU DELFT	STRUKTON	KLOET ONDERHOUD	CBRE
<b>What are important factors in a professional maintenance department?</b>	1.the quality of the people	<b>NONE</b>	1. Integral quality	Employees should have the knowledge:	1. The possibility of use in the design and functionality.	1. Knowledge organisation	1. Planning
	2.the product and services of the people		2. Success factor	1. In technical	2. Maintenance cost	2. Policy stability	2. Cost
	3.understanding the level of maintenance for each building		3. Change optimization	2. Buildings	3. Risk driven maintenance	3. Openly organise	3. Long-term visibility
				3. Long term relationship	4. People that not only can handle technical problems but also	4. The use of standard	4. Communication

<b>Do you think the five enablers of the EFQM are important?</b>					customer services & communication.		
						5. Responsibility in every sense	
	Ranking of the importance of EFQM enabler:	All enablers are important	All enablers are important	Ranking of the importance of EFQM enabler:	All enablers are important	Ranking of the importance of EFQM enabler:	Ranking of the importance of EFQM enabler:
	1. Process, product and services			1. People		1. Leadership	1. Strategy
	2. People			2. Process & Services		2. Strategy	2. Process and services
	3. Strategy			3. Partnership & Resources		3. People	3. Leadership
	4. Partnerships and resources: it is not important			4. Strategy		3. Partnership	4. People
	5. Leadership : it is not important			5. Leadership: less important		4. Process and services	5. Partnerships
	Some aspects are not important:	All aspects are important	Some aspects are not important:	Some aspects are less important:	All aspects are important	Most all aspects are important	Some aspects are less important:
	1. Leader is involved with stakeholder		1. Maintenance policy	1. Manage the change & flexibility			TCO/LCC
2. Setting supplier goal		2. Different strategy of PPM and Reactive maintenance					

<b>Do you any have additional opinions toward important aspects of mature maintenance departments?</b>	3. Manage organization's building assets						
	1. For PPM the most important enablers are strategy and process	The types of contract are important. It has to state everything clearly towards the supplier performances.	1. Understanding the concept of entrepreneurial cooperation for maintenance organization will add value	The concept of "change integration" is important, this is means that maintenance department also focus on the outside of the organization.	It is important to emphasis on working together	Social control is more important than rational control, because rational control lead to opportunistic behaviour.	Efficiency in the organization is important. Sustainability in the organization can lead to efficiency.
	2. To achieve quality is the combination of "Process, Products and Services" with people		2. The PPM and reactive maintenance cannot be differentiated because it is more on the operational level not on the strategic level		People should be encouraged in developing EQ rather than IQ.		
	3. It is important to have a good structured organization				Risk driven maintenance is important.		
	4. It is important to make separation of contractual model for owner and user.						

	5. The triangle in real estate management that will affect the quality : property manager - technical manager - administration						
<b>Key words</b>	<b>Long term planning</b>	<b>New ways of working</b>	<b>Change optimisation</b>	<b>Strategy per building</b>	<b>EQ</b>	<b>Social control vs. rational control</b>	<b>Efficiency, sustainability</b>

## APPENDIX III

### INTERVIEW TRANSCRIPT

#### 1. Key Person Of Gemeente Delft

The Gemeente Delft has 300 objects building. Monuments, offices, these are ownership of the municipality. We take rental, etc., that important for the city.

*Interviewer: You also do the maintenance?*

*Interviewee: Yes, we have property manager- technical manager- Administration. It is triangle of working. Property manager have contact with people outside.*

The technical managers do the maintenance work that related to the building object. The administration will do the administration of the technical works.

*Interviewee: Your focus is the technical and maintenance?*

*Interviewer: Yes*

*Interviewee: That's the people in the triangle are working together. And have to contact everyday. On the maintenance of the building we have the long term of the scheduled maintenance that has to be done. And every year, we have the plan that the technical manager has to do with the building.*

*Interviewer: So the maintenance is already scheduled every year?*

*Interviewee: yes for the next 25-30 years we have a plan*

*Interviewer: until 30 years?*

*Interviewee: yes. And every year we check the plan if its necessary to change the room or installation, we always check if the thing have to be done, not have to do in 5 years. So we have a plan for what and when we should do the maintenance, and also the money.*

*Interviewer: Do you categorize the maintenance plan it per building?*

*Interviewee: no. Each building has each plan. And each building is categorized.*

The categorized of the building is rather specific, such as a paint work, installation, roof, everything in the building, what we should do is in the plan, and its only for the owner, because we have different, between the owner and the user plan, and it is in the contract we made the separation. What's for the owner and the lessee. Lessor is lease contract mostly for 5 years, and how much is the sqm, the municipality, the other party. We only do the things we do for the owner,

*Interviewer: Do you also have the responsive maintenance?*

*Interviewee: yes we have a specific contract for the urgent things, and we call the suppliers to fix the problem.*

*Interviewer: so the owner will complain to you and you contact the supplier?*

*Interviewee: yes. When its something for the owner. Usually it's for the installation, and we call the supplier.*

*Interviewer: so you make different contract for planning maintenance and responsive maintenance?*

*Interviewee: yes, we have the responsive maintenance and long-term maintenance. Each of technical managers have its own building for the long term. And we have the daily maintenance. We separate it.*

*Interviewer: now I will ask you about 5 criteria what is the most important things for this department to make it more professional?*

*Interviewee:* we have 3 levels of maintenance for our buildings. And it depends on the function. Is there any vacancy or is there any long-term user in it. And we have the lowest category is the safety that is the most important. Then we have the normal maintenance, and we have aesthetic especially for the monuments. Because in the monuments we have some obligations related to the law and we want to see them good. And for the maintenance the most important thing is the quality.

*Interviewer: what about the people, do you think it is important?*

*Interviewee:* not everyone can be a technical manager. And that's why they are educated with the technical education. Mostly at the specific school, and yearly its change by law to take education to keep update.

*Interviewer: do you also give training?*

*Interviewee:* yes we give training, lectures to see the new change and innovation.

*Interviewer: what else do you think it is important?*

*Interviewee:* yeah we think it is the quality of the people, and the product that they give, and the capacity of the technical manager. Not only the internal but also external. They have to manage the relationship with the users, suppliers. In the planning maintenance we describe it in euro, we already prepare the budget now. In the lease contract we have some rent, the tax, insurance, maintenance, reservation for the finance, is in the balance sheet. There are 5 components in the rent. We have long-term average.

*Interviewer: do you incorporate the TCO in the balance sheet?*

*Interviewee:* yes. This is the life cycle cost. Because in 20 -25 years it will be different.

We also scheduled the daily maintenance, yearly. Could be yearly contract for responsive service. The balance sheet different for maintenance, and income, we have different management information system.

*Interviewer: do you think these 5 criteria are important?*

*Interviewee:* I think process, product and services is the most important. I think people are very important. I think strategy is the level of maintenance for the building. For the new building we have the new strategy. Partnership and resources I think it could be change every time. You will have different partner for each building. Knowledge is important

Leadership is I doubt of that. What do you mean with the leadership?

*Interviewer: why do you doubt about it? Do you think the quality of leadership of the head department of maintenance department is important or affecting the quality of maintenance?*

*Interviewee:* yeah, could be because maintenance is part of the system that you working in. I see the strategy of the management is important. It's not only the leadership of the management. I think if they put the philosophy, but the people are most important. For example in this department, the "triangle" structure of the organisation is more important than the leadership of mine.

*Interviewer: for these 5 criteria do you think it will be different for planning maintenance and responsive maintenance?*

*Interviewee:* I think for the long-term maintenance, strategy will be more urgent than the daily maintenance. Because the daily maintenance, you can solve the problem by calling the supplier and the problem solved. And in the long term, the strategy will be more on the process, product, service is more important. For the daily maintenance the quality of the people is more important. You have to take action.

*Interviewer: now I will ask you about the detailed criteria about the sub aspect. First I will start with the sub aspect of process, product and services. Do you think supervising maintenance is important?*

*Interviewee:* yes. It is important because the technical manager is responsible for his building. And he has to know everything about the building. So he has to be has helicopter view about what is happening. And supervising is important.

*Interviewer: and next is about responding client feedback. Do you think it is important?*

*Interviewee:* mostly the feedback of the property manager is the client, and not the technical manager. Technical manager has the communication with the supplier but not with the user. That's in our organisation, and the process as well with the property manager.

*Interviewer: do you think in response the client's it will be different for planning maintenance and the responsive maintenance?*

*Interviewee:* I think the communication is more direct in the daily maintenance. And in the long-term maintenance is more on the process.

*Interviewer: do you want to add more criteria in these proposed aspects?*

*Interviewee:* we already talk about the quality of the maintenance, and the levels. So I think the quality of the level of the maintenance is important.

*Interviewer: And now we move to the second criteria, it is setting suppliers goal. What do you think about this?*

*Interviewee:* it is not an aim of the organisation because for example you can call the suppliers anytime you want. It is for daily maintenance. To solve the problem is more important than the partnerships or the collaboration. To make it easier with the working process, partnership is more important. We have a system with the supplier. We ask for the services. There are some company with their offer. We choose supplier and we know that if communication with them is easy, then the process is easier.

*Interviewer: you also chose the best supplier? Or their availability is the most important?*

*Interviewee:* yeah. For example if the lift services, so the supplier should be from the same supplier because the guarantee is important. Sometimes there is an obligation to choose a certain supplier.

*Interviewer: the second sub aspect is about managing the building asset, equipment, material in a sustainable way. What do you think about it?*

*Interviewee: it is less important I think. Because I think we have the maintenance for the building is the most important. And sustainable is not too important because we are in a public organisation. When we build a new building it is important. But the old buildings we don't have invest in sustainable material. We just keep it according to the existing building material.*

*Interviewer: and the third is about the collaboration.*

*Interviewee: yeah the collaboration is to make the work easier.*

*Interviewer: for the daily maintenance and the planned maintenance the collaboration will be different right?*

*Interviewee: yes, it is in another types and another way of collaboration.*

*Interviewer: what will be the difference?*

*Interviewee: we see in daily maintenance for services, and time is so important. And the planning maintenance the quality and expertise is more important. It is on the different level.*

*Interviewer: next is the use of the technology.*

*Interviewee: yes, we have special software for the real estate management. And property management and technical management and administration, this software is come together. I see the technology is more important now for the maintenance. The development of the technology is making more easily not only in the office but also in the outside. We can work with ipad in outside. It will be the next step. The technology will make the work easier.*

*Interviewer: and TCO. You already mentioned it before right?*

*Interviewee: yes.*

*Interviewer: and the procurement process. Do you have the different process for planning maintenance and daily maintenance?*

*Interviewee: for the daily maintenance you don't have a long-term contract. And for the planning we make for a work for the work that has to be done.*

*Interviewer: do you think this is important?*

*Interviewee: yes process and regulation is important for the maintenance department*

*Interviewer: what do you think about the next sub aspects of the leadership? Because you already mentioned before that the leadership is not too important. What about the sub aspects?*

*Interviewee: yes, when the process is ok, then the leadership is not necessary anymore.*

*Interviewer: what about the integrity and transparency of the organisation?*

*Interviewee: well for the public organisation It is important to have transparency. And you have to follow with the rules, because everybody is looking at you. You are like an open window, so you have to ask several supplier to do a work, we cannot ask one. There are rules for the transparency.*

*Interviewer: and the others? Like leader have to encourage the people to do some improvement?*

*Interviewee: yeah, you have to set some goals especially for the people. And that's what we are doing. For doing the planning maintenance for year plan. And the technical manager knows what they have to do in a year. And if they don't finish the work they have to explain it. They have to do and finish some goals. I think if your people are on the right level, this is no necessary (leadership aspect).*

*Interviewer: now it is about the people. The sub aspect of the people should have recognised and developed by the organisation.*

*Interviewee: they have to develop also in the knowledge and behaviour. It is more important because the people will define the quality of the organisation's performances.*

*Interviewer: and about the innovation and the control of the organisation? Is that also important?*

*Interviewee: yes, because if they are fit in the organisation, if they fit in the culture, they will stay longer. They will not search another work. I think it is the most important. Because as an employee you will be more spend your time in the office than at home. So when you don't like it at the office than it is difficult to get achievement. And when you have a good culture and they are happy, the quality of the work will be better.*

*Interviewer: so you think all of the criteria is important right?*

*Interviewee: yes,*

*Interviewer: and the last aspect is the strategy. Knowing the needs of the stakeholder aspect. Do you think it is important?*

*Interviewee: yeah. I think the strategy is very important because they can know what is their achievement where are we going. And also to develop you have to make steps further. I think it's not only in the management, but also it is something that has to come from them. That's required to talk a lot with them about the strategy and the description. About the planning, it is a system that we will be use for the building. What is the planning for the 20-25 years, and what has to be done, what have to do, and for when? We call it "conditie meeting" and it is the next goal that's how we develop the technical manager. So we have the strategy to change. And the maintenance strategy will be better.*

*Interviewer: is type of your plan is coming from the client's request or it is the initiative of your organisation?*

*Interviewee: no. At start of the year we already decide what we have to do with this building. And it stated in year. And we discussed that with the technical manager. And the last year we had a difficult situation for the technical manager. There was a lot of maintenance for 2015 that has to be done. So there are lot of works. So*

that's why we hired some employees, because the workload is too big for the three technical managers that we have. So I think its important when making decision it is not top-down. When it is top-down it doesn't work.

*Interviewer: do you also do some object valuation?*

*Interviewee:* I know almost all of the building. I know the change of the building. And we will discuss specially when there is big work coming up, then we discuss it when which cause, is it necessary, or there could be some damage now in the building, we discuss the problem, solution and when is the best time to do it, so I bring with the material about what's going happen to the building. And I have contact with some of the project leader of the building, and also with the suppliers. But I manage the cost and the planning and the process.

*Interviewer: is there any external organisation?*

*Interviewee:* mostly we hire the external organisation, like consultancy, architect, or advisor, it depend on the permit. And we ask for the external companies to ask for their expertise.

*Interviewer: so, do you already have the maintenance policy? But do you think it is important?*

*Interviewee:* yeah we want to be a professional real estate organisation. and last year there were study in our department and in the Netherland we are one of the professional who has a professional real estate management. Not only in the public organisation, but also other organisation. We know exactly what building that have which lease, ownership, contract, maintenance, and not every municipality has it. Probably because we start it from 2006 and now we make our step. Now since the economic crisis, so the municipality want to know what is the real estate. Now more municipalities want to know more about the real estate management. But we already started it early.

*Interviewer: so the system has the important point here?*

*Interviewee:* yeah, this is the basic. It is easier to work it. And develop it. And you have to structure your organisation, that thing that makes the process, product and services are important. And if the processes with the right people it will make the quality out.

*Interviewer: do you want to add more important factor?*

*Interviewee:* I think the organisation, not only the maintenance; the real estate management should be good, and also the contract. If your contract management is good there is clear difference between the cost of the owner and the cost of the user. So it is also the property management. Organisation has to be good. It is the triangle organisation that I mentioned before it has to be good. It is Total quality of the organisation must be good. The triangle has 3 levels, operational – asset management –strategy. For the technical manager he has to know what to make the cost low and the quality is good. So we think about what we have to do in the future.

*Interviewer: for the supervising work of maintenance, do you supervise by your self or hire external organisation?*

*Interviewee:* The technical managers do the supervising by themselves. When the work has to be finish. They go to the location and supervise it, to look at the job if it is good or finish, or need more improvement. But for the bigger work we hire external organisation.

*Interviewer: what if they client have complain to you?*

*Interviewee:* first the complain will come to the property manager, and if he can solve it. and if not it will come to me.

*Interviewer: how do you handle with complains?*

*Interviewee:* it is sometimes difficult. We separate between public and private. We have public law. But as the owner of the building they have private law. We are working in the public organisation, and it is conflict with each other. It is the public building but the ownership is the private law. We are the public organisation we don't do commercial. The owner can be private company. But by law the municipality still have responsibility on the monument building.

## 2. Key Person of TUE Real Estate Management

*Interviewer: What is your opinion about maintenance department? Can you mention 5 most important things?*

*Interviewee:* I have 3 things that important. The first is integral quality, then you can find also in the document that I giving you. And other are success factor. The third is change optimisation.

*Interviewer: what do you mean with the success factor? Do you mean that success factor is success that coming from inside of the organisation or the success for the maintenance?*

*Interviewee:* success factor products. The users value and when we speak about success we speak about success of our department. We are real estate and housing department of TUE. What are our factors to be successful?

*Interviewer: ok. So it is about insight of the organisation and also its product?*

*Interviewee:* yes. But in the chain it is also important for the suppliers to know what is success factor, and what kind of behaviour that they can use to influence the success. It can be the quality, cost, and innovation.

*Interviewer: first I want to ask you about the process, product and services. What do you think about this? Do you think that this is important?*

*Interviewee:* yeah. I know these factors. We call it in Holland INK. I know it. And we use it also in our organisation. For me every aspect is for me important. For me what is difficult about your question is the scope of the questions when you talk about the plan preventive maintenance and responsive maintenance.

*Interviewer: yeah what do you think about that different types of maintenance?*

*Interviewee:* the problem is the plan and responsive are. We haven't contract with that kind of different. When we contract suppliers, the suppliers do the thing together. That's a little bit difficult. I think when you speak

about the strategic area, or tactic and operational. When you call about PPM and responsive it is operational level, it is not on the tactical or strategic level. For that reason it is written in the paper (paper of R. van Natterm) about the types of contracts. You can see that the risks are important. What kind of risks that you give to the supplier to manage it. And it's always the question about the strategic level. About hat kind of risks you can manage, and what kind of risks that you give to the supplier because you think that he has more knowledge and it that he is more able to do something with the risks.

*Interviewer: do you think this will affect the budgeting in planning the maintenance? Because maybe with the different strategy it will affect the planning, budget, etc.?*

*Interviewee:* reactive maintenance is the part of it. Yeah we know that there are plan and reactive maintenance. This is the most important place to be. But it is not the main issue. What is more important is to attribute the kind of risk that you have in the maintenance but also the user value. There are also a lot of risks. There are financial risk, commercial etc. when you have performance contracting, your supplier manage all the kind of risk. When you have contract for hours only, when you have the plan maintenance/ responsive you pay only per hours of duty so they take only financial risks.

The main part of the maintenance is for users value, for the main part of the university. When we look to do the part of the plan and not planned maintenance, when I look about integral quality, we took a different aspect. When we see the document, we talk about sustainability, security, health, comfort, and users value, esthetical, functionality. When we talk about strategic level that are the main part. When you use only about PPM and responsive it is very difficult for me. I think it should be the total quality of the real estate. Then I talk about the entrepreneurial cooperation it is more important. For me to maintain building it is not only important to contract your supplier but also to work together. And that kind of work together you can read in the documents.

*Interviewer: ok. And now what do you think about the sub aspects? What do you think about the sub aspects under the first, responding client's feedback?*

*Interviewee:* it is important to give feedback to the client. When you talk about the specific problem that you need feedback if the problems are solved. But that's not must increase expectation. That's important. Sometimes you see the responding the client's feedback, the expectation is increase, and you give them the form or idea that next time the problem is not repeated. But in the next problem they are not satisfied because it is increasing.

Supervising maintenance activities is OK.

*Interviewer: do you want to add more sub aspects under the process, product and services?*

*Interviewee:* Yes. Change optimisation and the client-supplier relationship. We try to fix more in the part of client-supplier. Try to find the effective things in that part.

*Interviewer: what kind of change it is?*

*Interviewee:* you have the user and have the department of housing and supplier. Sometimes you look only the part of user, with the contract, and monitoring that part of contract. But this is about the concept of entrepreneurial cooperation, is that suppliers and department work together, and together also fix the relation between the organisation and the user with performance indicator.

*Interviewer: for the next questions, do you think all of these sub aspects are important?*

*Interviewee:* what is very important for me is the link between the supplier and our department when we speak about data. We can use the data of supplier and the supplier can use our data. Those things are the kind of communication partnership.

What in manage collaboration with the maintenance market what is important is to put in the contract how will you cooperate. Because usually in the contract we don't have any impression, rules or guidelines is not stated clearly. For the supplier goal, the PPM and responsive maintenance for me it is too operational. But they don't offer it independently. For that reason I don't think that you can give different goal on it.

*Interviewer: what do you think the sub aspects of leadership?*

*Interviewee:* when we talk about improving that's of course yes, it is important. For me the PDCA cycle is very important. And its never perfect its also important on how to do it. Transparency and integrity is of course important. And when we talk about the organisation adapting to new challenge with the stakeholder, and also the supplier. Suppliers are also important. For me its also important to involve users value. The mission and vision of the organisation, for me the scope of PPM and responsive then I say that is not in the tactical level.

*Interviewer: people aspect what do you thing?*

*Interviewee:* development human resources it is important. There are 2 parts. The first part is the knowledge of technic. The second part is the behaviour/competence. And it also communication is important. Sometimes are more important than the technical knowledge. Innovation and creativity yes it is important. I think about sustainability and energy saving, and energy management.

*Interviewer: what do you think about control in organisation?*

*Interviewee:* yes for us is the control of the supplier. The supplier control and organise the part of plan and reactive maintenance. And we talk about "Odette". It is about the supplier control their own processes, the quality, and we control only the part of the reactive maintenance components. In the contract, we ask the suppliers to control and report the process of maintenance. And also in the meantime we take some problems that are necessary to control.

*Interviewer: by using this strategy, how to make sure that the quality is good if they control them selves?*

*Interviewee:* every month they report, and organisation set the performance indicator and they report on the performance indicator. And between the months, the people from the maintenance department will control in the object. This is much more effective to control in a very intensively one part. To control everything is impossible.

Managing stakeholder we do with 5 years plan. We use the document to manage the stakeholder.

*Interviewer: what is inside the 5 years planning?*

*Interviewee:* when we talk about the stakeholders it is about the board of the university, faculty and the end user all that kind, financial, TCO, users. We discuss the plan in 5 years. And every year we mention our activities of reactive maintenance or replacement. We mention not only the quality of the building and also the every part such as sustainability, health, functionality, etc.

*Interviewer: what do you think about strategy?*

*Interviewee:* when we talk about PPM and responsive, maintenance policy is not important.

### 3. Key person of Gemeente Rotterdam

*Interviewer: do you have any important aspects outside of the aspects of EFQM that I mentioned?*

*Interviewee:* no. I don't have. I think these 5 aspects are important.

*Interviewer: What do you think about the first aspect?*

*Interviewee:* my opinion about process, product, and services is this is important. I think all of the 5 elements are important.

*Interviewer: and what do you think about the planning maintenance and responsive maintenance?*

*Interviewee:* this question is little bit difficult for me. My role is a contract manager of 9 swimming pools and energy service contract. We have commissioning responsibility. Strukton (supplier) is responsible for the maintenance and energy service for 9 swimming pools. We have the contract and that's why the process, product and services are important. I have example here about the condition levels, and we ask the strukton (supplier) the level between 1-3. Is the good condition or not. 4-7 is low. Thus, the products are essential. We have a table that specifying the responsible of the supplier. So that the quality of the water quality also their responsible. You have the components of the building, the security, water elements; this is all of the responsibility of the supplier. That's why the products I specify, what is the level that the supplier has to do, and also the services for the planned maintenance and responsive maintenance.

*Interviewer: so there will be only one contract for every types of maintenance?*

*Interviewee:* yes. The contract is where everything is integrated. You also can have contract for daily maintenance. And the planned maintenance is outside of the contract, but the organisation can give the plan for the next year. And they will advice the supplier to change the components. And there will be the cost for changing components. And we decided that company change the components or we will call the other companies when the price is too high.

*Interviewer: so this is also depending on their offer?*

*Interviewee:* mostly is from the same company, but sometimes they escape. But the ideal contract is all in. so there is no different between the planning maintenance and daily maintenance. So I think if to change the product, and introduce the higher quality maintenance so there will be less daily maintenance.

*Interviewer: how is the tender model?*

*Interviewee:* we ask the market which companies can do the work. And we select 3 companies. And then we speak we them and look into the building and investigate the condition of the building and then make the price.

*Interviewer: and you choose the cheapest price or the qualities?*

*Interviewee:* we choose the quality and price. We have a system that the maintenance price is important but we also look at how they organise the maintenance. They should have able to handle the risks. They get point with the risk management. This is the product and price, but the process also important in the tender. And by process is for us also important, and also the reaction time. The partnership is very important because it is long-term contract. 10 years contract is long. So we also select the partnership. The partnership of the companies is with other contract.

*Interviewer: what about the partnership with the user?*

*Interviewee:* yes it is important. I have meeting with the swimming pool manager once a year, and together with the project manager of the supplier. And it is important to think about the feeling of manager of the swimming pool on the aspect of maintenance. And we can also follow the number of the daily maintenance and failure. It is important that the failure is not too much. The resources aspect, it is important because we have energy performance contract. We care about the sustainability. I'm also the manager of sustainability of our building, also the sustainability of the material the use. When the material are good, it last longer.

*Interviewer: do you make different contract between users and supplier?*

*Interviewee:* we make the contract with users to use our building. Our department is owner of the building. And we rent the building to the department of sport and culture of Rotterdam. We are the real estate department. We are the owner. The culture department is the user. We make the contract with supplier for maintenance. But we can also make 2 or 3 contract, between us and company, company and user, and user and us. It is the

maintenance contract, service contract, and rent contract. Then the reaction time is not important to us, but between the supplier and user.

*Interviewer: next is the people enabler. What do you think?*

*Interviewee:* Our organisation now is decreasing. It became smaller because of the cost. So now we have outsources. So the people should have skill to manage the contract. They are so important. The strategy aspect is important. Because of the future and also because of the cost, everything must be less cost in the future. So you have to optimize your people and organisation to do strategy.

*Interviewer: so what kind of strategy it is?*

*Interviewee:* the strategy is outsourcing. We don't do daily maintenance. Now we give the commissioning task to the supplier. We expect the quality of the building will remain good according the contract. So the users directly contact the supplier when there is a problem. And there is also reaction time. When the time to solve the problem is not sufficient then we give penalty. The suppliers must pay to us. And we also give the money to the user.

*Interviewer: how long is the contract last?*

*Interviewee:* it is 10 years.

*Interviewer: what do you think is the object valuation?*

*Interviewee:* yes it is important. We have the part of the maintenance, planned maintenance, service maintenance, chlorine for swimming pool, the supplier have to check everything. It is important to know where they are responsible and also the quality. We have level 1-6. We check the level. If the level is 4-6 then they have to repair. We check it on the 4<sup>th</sup> year, 8<sup>th</sup> year, and then 9,5<sup>th</sup> year. And 10<sup>th</sup> year is the end time. We also have meeting to get feedback from the user. And they can also contact me when they have problems. Once in the 6-week we have meeting with the manager and suppliers of the 9 swimming pools. We talk about the overall quality. We also can change the contract because of to closing contract.

*Interviewer: so it is also possible to change the contract in the middle of the contract.*

*Interviewee:* yes

*Interviewer: how do you check the user's satisfaction?*

*Interviewee:* we can also check the number of failures. But we also have meeting with user once in 3 months.

*Interviewer: what about the using of technology?*

*Interviewee:* yes it is important to check the indicator and target.

*Interviewer: what kind of technology that you use?*

*Interviewee:* that is the hardware and software. The supplier use new technology that they can see when there is electric problem.

*Interviewer: what do you think about manage the collaboration?*

*Interviewee:* I think this is also important. I think this is important to be clear in the contract. The collaboration is very important because it is long-term contract. The relationship has to be good. We make appointment for meeting between user and supplier, and we can also check it. I facilitate the process. The relationship between the three is very important.

*Interviewer: what about setting the supplier goals?*

*Interviewee:* The reaction time is important.

In the tender phase we have to think about the goals. Then give the goals to the supplier, because when the tender phase is ended, we cannot give new goals, because suppliers will ask extra cost.

*Interviewer: next is to manage the resource of organisation.*

*Interviewee:* yes it is important to manage the sustainability. It is one of the criteria to select the company.

*Interviewer: what about your own organisation or office? Do you manage the sustainable factor?*

*Interviewee:* yes. We have sustainable goal. In this contract we have the level of the energy building. In the tender phase the company get the points in how they can increase the energy level of the building. The suppliers have to make proposal to substitute elements of the building because of the sustainability goal. In this contract also here is energy.

*Interviewer: the TCO?*

*Interviewee:* yes. In the contract of the 10 years, we have to rebuild new school. When we use design and build contract and maintenance then you have the aspect the aspect of TCO in the contract. If only build contract then the TCO is less important.

*Interviewer: procurement process and procedures?*

*Interviewee:* yes it is important. Furthermore, we are the public organisation organisation.

*Interviewer: appropriate contractual model?*

*Interviewee:* yes. We can also use contract for daily maintenance and different planned maintenance. Depend on the money available.

*Interviewer: Continuously improving?*

*Interviewee:* yes it is important. We have fewer employers. We have to improve the skills and knowledge. We have to do more different things, and have the more knowledge. The number of employees is reducing from 120 to 85. Transparency and integrity for government department is important. The change and flexibility is also important. The world is change everyday. It is difficult for long-time contract. When there is problem in the middle of contract, we have to be flexible. Set the mission and vision is important. The vision is let the market

to do what they can do. Then we give them the framework. But as government, employees have to do everything.

*Interviewer: what is the specific mission?*

*Interviewee:* it is to do better even with the less resources. Our department have a commercial building we will sell it. We want to have fewer buildings for the government employees.

*Interviewer: what do you think about the leadership it self?*

*Interviewee:* yes it is important. But the leader cannot tackle the rules, because the leader is the example of the department. However, nobody tackle the rules in our organisation. The control behind our department is in financial control and procedure control.

*Interviewer: what about developing human resources?*

*Interviewee:* yes this is important. The people must be trained to learn new things. But the fact that now we have less money, so the training is decreased.

*Interviewer: innovation and creativity?*

*Interviewee:* yes it is important. But we look and speak with the market to look for the new idea.

*Interviewer: control in organisation*

*Interviewee:* yes the financial and procedure control is important. The control of the leader to the employees is important. We have new work, and then the control of the leader is decreased. People are expected to responsible for your own work and give a good quality. The leader checks only the products. The stakeholders are the users of the building. They are important. We maintain a good relationship with them, especially with politician. They are important for the public organisation.

*Interviewer: what about the strategy sub aspects?*

*Interviewee:* it is important our policy is to outsource.

#### **4. Key person of TUD Real Estate Management**

*Interviewer: what do you think is the most important things from maintenance department?*

*Interviewee:* I think it is the knowledge of the employees, technical but also the knowledge from the building/ assets.

*Interviewer: what about the attitude of the people in the organisation? How is their professionalism?*

*Interviewee:* I think the professionalism is coming from the technical knowledge, such as the new changes and technical development. And also in maintenance, you have to maintain a long-term relationship. For maintenance the relationships and attitude is different if compare to the project of new building. The approach is different.

*Interviewer: I have the EFQM enablers; do you think all of them are important?*

*Interviewee:* I think from the model, people are the most important. And also it is important to define how do you deliver the services and the partnership you have, and how to develop the partnership with the supplier.

*Interviewer: And what do you think about the partnership with the client?*

*Interviewee:* yes, we are here is part of the client. Our department here is part of TU Delft. The relationship with the client is essential. but because we are one organisation so it is relatively easy to maintain the relationship.

*Interviewer: So leadership is not too important,*

*Interviewee:* I think it is important but less important than having the right people to deliver maintenance. And you have the products define how we work, what you're expectation from the supplier. If those step is followed than leadership is less important.

*Interviewer: and the strategy?*

*Interviewee:* I think strategy is important. In TU Delft we had 1 strategy for the whole campus. But we are currently working on making the approach for building differently. For example for the new building, the maintenance part is included in 30 years plan. Before we started the building we tender the maintenance part. That is for the purpose that the knowledge from the builders and also for the maintenance part. It is DBM contract.

*Interviewer: why the organisation has new strategy?*

*Interviewee:* The strategy needs a different approach for different types of building. If we have 1 type of building, some buildings are having too low maintenance. The older building, in our strategy we have for few years. If we maintain the old building for the same level, it is way too much. So we can make sure that the have the right level of maintenance and cost. Our main goal is to make sure that the building is available for university. But we also have the social responsibility. And spend the money wisely. It is more difficult to give the responsibility to the maintenance partner if the building already exists in few years, because the part of the building is already difficult.

*Interviewer: Now I want to ask about the sub aspect of the first enabler.*

*Interviewee:* we also use NEN tool. But it is mostly useful to make sure the financial value of TU Delft is good. But it is not useful to make agreement with the partners. If I want to sign with the contractor to provide with specific level we want, it is not working because we have to make additional agreement. For the daily maintenance it is not important. But maybe it is useful for preventive maintenance. It is based on the life cycle, we use the condition about 95% of life cycle.

*Interviewer: So how did you manage the preventive and daily maintenance?*

*Interviewee:* yes, it is different. It is contracted with supplier. We describe the requirements. That is something that we want to change. We only describe the functional percentage, and the maintenance partner and strategy.

*Interviewer:* so it is about the performance contract?

*Interviewee:* Yes. The performance contract is for the new building. And the daily maintenance we make a list of the things that suppliers have to do. Because of the big maintenance scheduled to replace a big building part, now we are doing the renovation. Maintenance is planned. But it is difficult to make performance agreement with partner because the building is too old.

*Interviewer:* the next is about the supervising maintenance activities?

*Interviewee:* yes, I think it is important. Here we have specific employers for maintenance. They supervise all of the maintenance activities. I think it is important that the people have the knowledge of the building and they know what maintenance activities are in the campus. They have to know exactly what is the condition it.

*Interviewer:* do you supervising per project or per time?

*Interviewee:* we supervise bigger maintenance project, and important project. I make sure the budget and the maintenance schedule. It is based on the condition.

*Interviewer:* what do you think is the perfect situation is for supervising maintenance?

*Interviewee:* I think the perfect thing is to balance the right activities in the right way and make sure that it contributes to use of the building, and make sure that it is balance to the budget. So the price and the quality should be balance.

*Interviewer:* now do you think responding client feedback is important?

*Interviewee:* yeah, but mostly that the maintenance is not disturbing the activities of the people in the building. It is important to make sure we organise the project clearly.

*Interviewer:* do you have some system to respond the feedback?

*Interviewee:* in our project, we talk to the client that presented by the technical people in the building. We do some interview with the technical people of the building. In the process we have a feedback moment.

*Interviewer:* now it is applying technology is important?

*Interviewee:* we use the right technology for the maintenance schedule. Sometimes it can reduce the cost. We use proven technology only. We have facility management information system, it is Plano. We don't have all the process. But all of the failures is already stated there. From that system, they will deliver maintenance schedule. But currently we use excel. Only the corrective maintenance is only the small part.

*Interviewer:* Manage the collaboration with the maintenance market. It is important?

*Interviewee:* Yes, it is very much important. We tender our contract because we are government organisation. And now it is a longer-term. This year we do the tender for the insulation part. And we are checking what the suppliers give us. And what do we need.

*Interviewer:* how you manage the collaboration with them?

*Interviewee:* we do consultation as part of the tender process. After we know what we need, and it is the performance contract. We check what kind of supplier can deliver the best.

*Interviewer:* setting supplier's goal?

*Interviewee:* All of the suppliers are commercial. So the most important thing is to make sure that the goals of the suppliers and us are the same. So it is make sure the performance agreement. The performance should be 95%.

*Interviewer:* Next is managing the resource of the organisation in a sustainable way.

*Interviewee:* yes it is important. We can make a sustainable solution, if there is extra budget needed we can make request.

*Interviewer:* And TCO/LCC?

*Interviewee:* yes it is important. What we do is we align the maintenance schedule with the target of the building. So we put it in lifecycle. For the new building, the TCO is the basic for all. For the older building it is more basic. We only do preventive maintenance, we don't replace until it fails.

*Interviewer:* and procurement process.

*Interviewee:* yes, it is law.

*Interviewer:* what about the contractual model?

*Interviewee:* we have different group of buildings. We have different contractual model. So it is important. Especially for new building and old building,

*Interviewer:* Continuously improving organisation.

*Interviewee:* yes.

*Interviewer:* how it should be improving?

*Interviewee:* yes we have to use the suppliers followed by the technology and development by their area of expertise. We do the internal audit. We are checking if the procedure is good or can be improve. I think our organisation is already building new strategy. I think it is important but first prove that our strategy is doing right now.

*Interviewer:* encourage integrity, transparency.

*Interviewee:* yes, integrity is very much important. We have strict policy.

*Interviewer:* Manage the change and flexibility?

*Interviewee:* yes it is important. But it is not really essential. I think is the most important that we have the right people who know the building. Because it is possible we change the different people for manager, but I think it is not our primary process.

*Interviewer:* set mission and vision of the organisation?

*Interviewee:* yes it is important. Our vision of TU Delft and strategy are aligning. It is to make the process of education is possible.

*Interviewer:* Developing Human resources.

*Interviewee:* yes, it is the most important thing.

*Interviewer:* innovation and creativity

*Interviewee:* yes it is important. We have basic standard of our maintenance work. Technical innovation is important that people is enthusiastic using new technology. Creativity is mostly on the solution of maintenance. It is more technical.

*Interviewer:* control in organisation?

*Interviewee:* yes, it is important.

*Interviewer:* what about managing stakeholders?

*Interviewee:* yes, we have weekly meeting with the service organisation. It is the technical people in the building. They are first responsible to notice the failure in the building. We make sure what is the problem and the supplier perform and make solution.

*Interviewer:* what about the maintenance policy

*Interviewee:* yes it is essential. You have to make sure that the policy and strategy is inline.

*Interviewer:* maintenance strategy

*Interviewee:* yes, I think it is important. But it is impossible to plan all of the maintenance activities. If there is failure there will be responsive maintenance.

## 5. Key person of Supplier company

*Interviewer:* Can you tell me about your company?

*Interviewee:* we are maintain and build and building and installation, such as climate installation, elevator. Especially the bigger building, mostly the customer are the university, hospital, and high tech campus of Philips in Eindhoven, university of Tilburg. My role is the commercial director of the region. There are 3 companies. There are 450 people working here. We have several bigger companies, and university, hospital, prison. We build them, we maintain them, and we explore them, but also engineering, development of the building. We also build tunnels. But mostly we do for the building and also building installation.

*Interviewer:* Can you mention 5 important elements that important for maintenance department?

*Interviewee:* I think it is the possibility of use in the installation. The possibility to use the design and its functionality. Also what is the expectation costs of maintaining the installation. We also look at the years coming and not only the installation cost. And how are they accumulate the cost, the energy saving, the energy cost, the inspection, legal inspection, we often look at maintenance as risk driven maintenance. We have 3 things: situation maintenance, it depends on the situation and how we use it.

*Interviewer:* what do you think that the public organisation can improve their professionalism?

*Interviewee:* risk driven maintenance, it is depend on the people. Sometimes there is a bigger role for supplier as a bigger maintenance company, because they ask more but they do not see the indicator. They should have people who also understand, not only about technical but also people customer services, which can handle the communication, customer services, and have mind-set of commercial/ business. They need to think in another way and not traditional, and improve working together.

*Interviewer:* Do you think these 5 EFQM enabler are important?

*Interviewee:* I think all of these are important.

But in process sometimes it is difficult, because there are maintenance systems and management system. They don't fit with our IT system. Partnership is often difficult, because they act as a leader. They need to develop a certain competence for partnership. Leadership in the government agency often seen as soft management, it is not about the business case, money value driven, and market driven competence. And strategy is very important because their strategy should in line with our strategy.

*Interviewer:* now lets start with the first enablers and sub aspects?

*Interviewee:* some organisation has an integral building quality measurement. And they use the NEN scale. Should think about usefulness and functionality. Yes this is a important element. It is important to choose what kind of maintenance you have to do.

*Interviewer:* is there any difference between the planned maintenance and the responsive maintenance?

*Interviewee:* yes, the choice the way to do preventive maintenance or responsive maintenance is depend on the object valuation and the level needed. It is important to have a different strategy for each building, because they need a different level of maintenance. It needs to make a diversification of maintenance strategies.

*Interviewer:* well, now it is about supervising maintenance.

*Interviewee:* I think it is important. The idea behind risk driven maintenance, mostly customer is supervise in traditional. In the future I think supplier should have a bigger role in supervising, also as an added value.

*Interviewer:* the next is about the responding client's feedback.

*Interviewee:* yes it is important. Now we have the management to get the feedback, but less often to use the feedback. This moment we only use it in reactive way. But we have to do it in proactive way. Now it is little bit traditional. I think should be working together. Working in total way. There are different supplier companies that should work together and not concurrent.

*Interviewer:* do you want to add more under the process, product and services?

*Interviewee:* I think about more on risk driven maintenance, I think should be less procedures on delivering maintenance and more responsibilities.

*Interviewer:* next sub question, about technology?

*Interviewee:* it is important. We need to improve the connection of IT. So it should be synchronized. It is important if we can check the system from the distance. It can also more efficient and effective. It can do the responsive maintenance before the users detect something wrong. It will reduce the corrective cost.

*Interviewer:* manage the collaboration?

*Interviewee:* yes it is important. I think collaboration is about the optimisation of working together with the customer. I think it is important to work together, to take responsibility for the whole and take the best solution.

*Interviewer:* what about set the supplier's goal

*Interviewee:* It is important. I think we can do it better. We can do more in output driven not about input driven. It should set the goals together. It should be more on the quality not on the quantity.

*Interviewer:* manage the resource?

*Interviewee:* yes, I think it is important. When we think about the sustainability it is also about reduce the cost.

*Interviewer:* TCO?

*Interviewee:* yes it is important. But public organisation sometimes does not incorporate it. They should be clear in their use of TCO. They should think about the return of investment.

*Interviewer:* procurement and procedures.

*Interviewee:* it is important. There some rules that written by the government.

*Interviewer:* what about the contractual model?

*Interviewee:* yes I think this is essential. Especially when developing the maintenance. It is also about the responsibilities, insurance, etc. for the performance based contract.

*Interviewer:* now it is the continuously improving

*Interviewee:* yes it is important. A lot costumers now want more the EQ. not only IQ. Because people in the technical organisation usually only think that IQ is the most important. Such as communication, emphatic, etc.

*Interviewer:* transparency and integrity?

*Interviewee:* yes it is important.

*Interviewer:* leader encourages it?

*Interviewee:* yes leader should have to be a role model. Such as always learning, having integrity, etc.

*Interviewer:* manage change and flexibility

*Interviewee:* yes I think this is important. People always use to work in the same way. The company must be very flexible. The public organisation is now developing 24/7 more opening economy.

*Interviewer:* leader set the vision and mission

*Interviewee:* yes it is important.

*Interviewer:* leader can tackle the legality rules?

*Interviewee:* yes, I think we can do in a better way. Because the problem is we have flat organisation but the authorisation is not flat. It will make the customer takes a longer time. It should not always the leader.

*Interviewer:* do you want to add more?

*Interviewee:* Don't always look only on the leader. But look also on the quality of the people.

*Interviewer:* Developing human resource?

*Interviewee:* yes it is important. Most of the people in the company have a lower education. People should do education such every 2 years.

*Interviewer:* innovation and creativity?

*Interviewee:* yes, it is important. But usually the innovation is difficult because of the cost. Some of the technical people are creative, but they need to get stimulated because sometimes they do something in the same way every year.

*Interviewer:* control in the organisation?

*Interviewee:* yes, control is good, but don't get to much control. it is important to look at the people, so that the people more competitive and working together.

*Interviewer:* managing stakeholder?

*Interviewee:* yes, it is important. We have multi levels contacts, such as technical level, financial/ strategic level. It is important to manage all those levels, and also external people, such as legal. Suppliers also have different roles in every level. I think it can be more effective if we are working together between levels.

*Interviewer:* now it is strategy. What do you think about maintenance policy?

*Interviewee:* yes it is important. It depend on what types of maintenance what you do, and there will be different maintenance. It is more output driven.

We have 3 types of maintenance: corrective maintenance, situation maintenance it is the maintenance that depend on the functionality of the buildings, and the one that in NEN 2767. The clients give the input contract and we develop the output contract.

## 6. Key person of Supplier Company

*Interviewer: Can you tell me what are your company activities?*

*Interviewee:* Yes, we are a family that own this company. We are real estate Maintenance Company, and interior decorating company. Our company have been 96 years old. I am as a general director or financial director. I am responsible for the strategy, external relationships and organisation structures. We do the consultation part, the whole plan and also the technical maintenance part such as painting, etc. Our company is working for the housing association, investors, hotel, all types of real estate owners and public organisation.

*Interviewer: What do you think are 5 most important things for maintenance department?*

*Interviewee:* First is knowledge organisation. There is a shifting, before people who working in those types of organisation have a lot of operational knowledge, and strategic level. There is missing level in the tactical level. It is important to know what is important to know how the organisation is form and how the organisation like us, it is about the process, we have to have connection with the technical people, and people from strategic level what are the market situation, and it is important to select the best proposals. It is depend on the situation. Maybe from simple contract or organise maintenance in alliances, for instance. The knowledge is the technical knowledge and the organisation process, and contract that we have.

Second is the policy stability. Real estate maintenance is on the long-term plan. We need to be able to make long lasting commitment with the partners in the chains. It is important to have policy stability not with the changing of managers. I think most of the professional colleagues; this is the most problem we face. It is need to be long term focus. Private organisations have different focus if compared with housing organisation, or government organisation. Private organisation wants less risks more return. So they have more stable policy. Third is the openly organise. They should actively go out and talk to stakeholders. Make reports about that and it can be use as input for the policy. It is open for ideas. It will prevent the single mindedness. Fourth is the use of standard. Such as the NEN, ISO, the EFQM model, maybe more and more societal things, as the basis for processes and decision-making. And the fifth is responsibility in every sense. When something went wrong don't stick with the procedures, and actively to find the win-win solution. Actively reduce the opportunities. Try to share risks and be more transparent.

*Interviewer: What do you think about the process, product and services?*

*Interviewee:* well I think it is important to use the model. So the first part is the leadership. But it will depend on where the position is start form. If we don't have a good leadership then it is difficult to achieve the other aspects. Yes I think leadership is important. I think the first is leadership, if we don't have stable focus then it is difficult to be a reliable partner. People is important, and of course the knowledge management. If we have the sand clock model in your organisation, then we have the policy and strategy behind that, so we have a better view, and how we organise the people. It is important. It can be a thread if we talk not with the people from technical. So it is important to be able to communicate.

Partnership and resources is about how open you organise the organisation, do you monitor the market, talk to them, and make sure you get the best practices in your organisation. Those are resources for your company. We deliver low risk high return. That is our services in maintenance.

*Interviewer: So all five of enablers are important?*

*Interviewee:* yes, leadership is the number 1. And the second is the strategy. And the third is people and partnership have the same level. And the last is the process and services.

*Interviewer: what do you think about object valuation?*

*Interviewee:* yes I think it is important. But I think it is important about the SCP (structure conduct performance). I would say that is what is the objective of the organisation. That it is important that for the low level, what are the performances of the object, and the definition of the object of the organisation, because that will give direction. So I think the object valuation is important if you know how to link it with the organisational objective.

*Interviewer: Supervising maintenance?*

*Interviewee:* yes of course. But I think rational of control like this is a waste, because in Lean, the checking is a waste because you don't trust with the other party. But doing so is an indicator of mistrust. If they want to so it then do it with the sample supervision.

So the asset owners is putting risk to the contractor so it is useless if doing the supervisor. I think the core of think is the control mechanism. There is rational control mechanism and social control mechanism. In social control the behaviour is not opportunism, but the rational control will be more expensive. But in social control can be fraud. So it is better in the middle between rational and social control. So I think in result-based contract I prefer the sample supervision, so it is not a blind trust.

*Interviewer: client feedbacks?*

*Interviewee:* yes, it is important. We have system with questionnaire.

*Interviewer: do you want to add more?*

*Interviewee:* I would say as long as it is objectify in the standard and norm, if they transparent, and to organise their own critique. Suppliers should be able to give feedback to the maintenance department. Because there is

power different, because they are our customer. If they can open with the critique it will make them a very professional organisation and will lead to efficiency. Because it is not healthy with power different.

*Interviewer: implementing technology?*

*Interviewee:* it's important if there is standard technology in the market, not only use our own standard of our own company. So it should be more integrated between the suppliers and owner. In ISO 55000, there is standard that we can link between the service provider and service owner. We want new software to update and link the reports. We want to have new software to discuss together with housing association about energy efficiency, to think more on strategic discussion. They should know what they want to do with the company before they want to know about the buildings.

*Interviewer: manage the collaboration?*

*Interviewee:* yes. So know there are more alliances. So we have multidisciplinary collaboration such as electric, plumbing, Construction Company, architects, and real estate, new development, renovation, and maintenance. We do alliance with other companies, and also alliances with our clients. We are looking more and more for working together because I think the fragmented maintenance market is going to concentrate. And we are the middle size company want to grow bigger.

*Interviewer: do you make agreement when making alliances?*

*Interviewee:* yes sometimes we set up the cooperation. Depended on what the success we have. Sometimes we make BV, and we make process through those joint venture. It can change depend on our customers. We also have the social side, such as involving the young people for training in the company with the technical skills.

*Interviewer: setting supplier's goals?*

*Interviewee:* I think there should be a discussion, set the goals together. Otherwise there would not be an agreement. It will depend on the type of the maintenance.

*Interviewer: manage the resources of the organisation?*

*Interviewee:* yes, it is important. A company should be able to be sustainable.

*Interviewer: TCO?*

*Interviewee:* yes. We only calculate our effect on the maintenance part. I think we can make lower the cost by result-based contract.

*Interviewer: procurement process and procedures?*

*Interviewee:* yes. I don't think it will not be different between the PPM and RM, only the content that it is important. I think there are lot more freedom in the procedures.

*Interviewer: appropriate contractual model?*

*Interviewee:* yes. I think the result-based contract is the best. But sometimes they forget the total goals and only focus on the KPI.

*Interviewer: continuously improving?*

*Interviewee:* yes, because if not then in time they can go downward. I think it is important to improve on the stability as the contractual partner in the leadership.

*Interviewer: transparency and integrity?*

*Interviewee:* yes. Integrity is important.

*Interviewer: manage the change and flexibility?*

*Interviewee:* yes. Be stable and know when to change, be accountable, that's a good leadership. If they can do that then they can realise the vision and mission.

*Interviewer: set the mission and vision?*

*Interviewee:* yes. It is important.

*Interviewer: Leader can tackle the legality rules?*

*Interviewee:* yes. It is important to obey the rules of safety. As leader it is better to make a stable partner.

*Interviewer: developing human resources?*

*Interviewee:* people can get more efficient, team efficiency. Also monitoring the competence, team building, that they should complement each other.

*Interviewer: innovation and creativity?*

*Interviewee:* yes. There should be procedures that can seduce people to be more innovative and creative. Bottom up organisation can be encouraged.

*Interviewer: control in organisation?*

*Interviewee:* yes. But not to rational control, because it can make people to make behave opportunistic, so more supervision. And social control is important.

*Interviewer: managing stakeholders?*

*Interviewee:* yes. We have to know what your stakeholders want; to make sure the plan is delivered, to be a successful plan, for the maintenance decision.

*Interviewer: maintenance policy?*

*Interviewee:* yes, I think it is important that the organisations have the policy, but we have to make sure that the policy is check and adapted with the specific buildings. That is not best for everything. And that's why result based plan is different for every different company. Sometimes, even the same buildings, but there is changing for the owner, then the policy is different. Because their want is different, there will be different plan.

## 7. Key person from Real Estate Company

*Interviewer: can you tell me what is your position and what is your organisation doing?*

*Interviewee:* I am the technical manager that works under the property management. And I'm responsible for everything that is technical such as cooling system, paintwork, and roofing. I work in the team, there is commercial manager, financial manager, technical manager, assistant, and together we make sure that the building is not only in the good condition but also to satisfy the tenant. We have property but it is on the different holding than ours. What we do is to make sure that the property is leased, and we also do selling or buying, we do valuation and there is department to make plan to do renovation or demolition. We also busy with the sustainability.

*Interviewer: what do you think is the 5 most important things of maintenance department?*

*Interviewee:* planning, cost, long-term feasibility (make sure that the building for 10 years is still in the better condition), communication.

*Interviewer: About 5 enablers of EFQM, what do you think about that?*

*Interviewee:* I think strategy is the first important, then process, products and services, leadership, and people, then partnership and resources.

*Interviewer: Then lets start with the sub aspects. First is performing object valuation?*

*Interviewee:* yes it is important. We take a look twice a year that the building is in the good condition, we look at the past about complain we had. We make sure that the problem is not repeating again. We use our own standard. We don't use NEN standard.

*Interviewer: do the object valuation performed is linked with the financial factors?*

*Interviewee:* no, there is a wall between it. Because we don't want the financial department is interfere with us. We want to be objective.

*Interviewer: supervising maintenance?*

*Interviewee:* I think it is important, because if they don't obey our rules, we have list of preferred suppliers. They have contact with us. We have certain rules to work. For example they have to respond within 24 hours, if urgent they should response within few hours. They have to be able to be contacted by tenants, and they have to contact us. Once a year we have technical meeting with technical manager. The entire plus and minus, and based on that we evaluate our vendor. And we can contact another vendor.

*Interviewer: responding client's feedback?*

*Interviewee:* yes if they have problems we have to make sure that the clients able to contact the vendor.

*Interviewer: applying technology?*

*Interviewee:* I think technology is important. We have a couple of program such as Microsoft office. But we also have Argo that collects different type of information, such as the budget that approved. And we have Yardi, it is a finance program, we make sure that the order, bills are there. Then we can connect the order with the budget. And we make sure that all the leases are paid. We can also check if there is repeated failures happened, for instance if elevator fixed many times, then we can call the vendor to ask what happen.

*Interviewer: manage the collaboration with the maintenance market?*

*Interviewee:* it depends on how you look at it. We search for the best market player, but it is not really collaboration. I don't think we can manage the market players for us.

The vendors are working for several building objects. If they don't do what we want to do then we say goodbye. The reason why we group the suppliers for specific building objects is because if we get suppliers from different area in the Netherlands then they have to travel far away. We have to pay their travel costs. So we group it per buildings and per area.

*Interviewer: setting the supplier's goals?*

*Interviewee:* yes. We want them to do what they should do. As soon as possible and what is the quality. But we can tell them how to do it.

*Interviewer: manage the resources of the organisation in a sustainable way?*

*Interviewee:* yes I think it is sustainable. We start to use technology than paper. We also apply flexible working. We use LED. We reduce the use of the ink.

*Interviewer: TCO/LCC?*

*Interviewee:* it is not useful for my division, but may be for the top level of my organisation.

*Interviewer: procurement process and procedures?*

*Interviewee:* yes I think it is ok in the fewer norms. I think because we only use the small part so we only have small procedures.

*Interviewer: appropriate contractual model?*

*Interviewee:* we have contract for different activities. We don't have renovation contract in our department. The entire renovation contract is by the landlords. Reactive maintenance is part of the contract. We don't have planned preventive maintenance, because the contract is based on per activities and per building objects.

*Interviewer: continuously improving?*

*Interviewee:* it is important. We always try to improve and apply the best practices.

*Interviewer: encourage integrity, transparency, effectiveness, and legality rules?*

*Interviewee:* it is important. We do every year; we invite the people from HR to get the course about the transparency and integrity. We get certificate. There is penalty for breaking the rules.

*Interviewer: manage the change and flexibility?*

*Interviewee:* yes it is important, because, the market is always up and down. Especially with the tenants we have. We have a strict policy, but we have to be flexible with what has to be to do with the work. If we need changes we can go to the manager.

*Interviewer:* set the vision and mission?

*Interviewee:* yes it is important. We have meeting to explain about the vision and mission.

*Interviewer:* developing human resources?

*Interviewee:* yes it is important. It is better to be from up and from bottom. Initiative from leaders and employees, as long as it will add value. We give courses. Everybody should be able to get training on his or her own level.

*Interviewer:* innovation and creativity?

*Interviewee:* yes it is important. Because there is a lot of parties to taken care.

*Interviewer:* control in organisation?

*Interviewee:* yes it is important. Managers can evaluate the employees what has been done right or less, get bonus. If something does not goes right then there is penalty.

*Interviewer:* managing stakeholders?

*Interviewee:* yes, I think it is important but on the top level. My division cannot do that.

*Interviewer:* maintenance policy?

*Interviewee:* yes it thinks it is important. There is a certain view of the landlords, so we take care the maintenance policy that is set maintenance policy. Our own maintenance policy is based on daily maintenance. That is toward the vendors.

*Interviewer:* maintenance strategies?

*Interviewee:* yes it is important.

## 8. Key person from Maintenance Consultant

*Interviewer:* Can you describe your company?

*Interviewee:* Yes, I am from Tiberius Maintenance.

Tiberius Maintenance is a maintenance consultant. As Tiberius Maintenance I'm participating in the NVDO Sectie Onroerend Goed. I'm involved with the ISSO project Duurzaam Beheer en Onderhoud as a delegate of the NVDO Sectie Onroerend Goed. As Tiberius Maintenance I wrote the ISSO publication 101 for the ISSO.

*Interviewer:* What do you think about my assessment sheet?

*Interviewee:* Overall, I think you have to define the scope of your assessment sheets. The maintenance organisation has the first level that consists of director as you name it as real estate manager or asset manager. The director monitors two departments, the project department and the maintenance department or facility management. The maintenance department connects to the suppliers. Therefore you have to define for which questionnaire is aim for, the asset manager or the facility management. By defining this different level in the organisation, you can design appropriate questions.

For example the topic about maintenance planning, the maintenance department and the supplier plan the short-term maintenance. While for the long-term maintenance, the director of real estate department or asset manager knows better for the cost estimation. So it is better to ask the question about the long term planning to the director, and the short term planning for the maintenance department.

*Interviewer:* Let's start with the first part about the process and services. What do you think about the first question?

*Interviewee:* I think the first question is clear

*Interviewer:* What about the second question?

*Interviewee:* The second and the third questions are similar. But it is possible to add the standard. For the second question, the standard can be added such as with NEN 8021 about the building performance, and NTA 8026 that take the data from condition assessment into a real estate strategy. It is also possible to split the question number 2 into the functionality of the building using NEN 8021. And the second is about the functionality of the installation, using NEN and ISSO publication.

*Interviewer:* What about the third question?

*Interviewee:* On the third question the standard can be added with ISSO publication. The fourth and fifth questions are clear for me.

*Interviewer:* Now the second part that is the Partnerships and resources. What do you think about the first question?

*Interviewee:* The first question is clear for me.

*Interviewer:* What about the second question?

*Interviewee:* The question is fine. However, the ICT system here has three different tools. First, the ICT tools are for the facility management, for example Plano. The second is the tools for the suppliers, mainly for the work orders. And the third is the ICT tools for the asset management. For maintenance organization, the Facility management information systems (FMIS) are the most important than others. The definition of a mature organisation here can be described as the ability of the ICT tools to connect to different software efficiently, and how they can organize it.

*Interviewer:* What about the third question?

*Interviewee:* The third question is clear for me. In the Netherlands, for instance the collaboration of the maintenance organization is in The NVDO.

*Interviewer:* What about the fourth question?

*Interviewee:* In the fourth question, the supplier's goal can be different for the traditional contract and the performance based contract. The behaviors of the suppliers for these contracts are different. I suggest results contract to achieve a better goal. In this contract, suppliers should deliver information that transparent. Here, clients also have right to define what they need.

*Interviewer:* What about the fifth question?

*Interviewee:* I think if the organisation following ISO 14001 the organization can manage resources in a sustainable way.

*Interviewer:* What about the sixth question?

*Interviewee:* This about the scope that I was talking about, the TCO/LCC is about the asset manager and not about the facility management.

*Interviewer:* What about the seventh question?

*Interviewee:* The criteria of a mature organisation can be added with follow European law or not.

*Interviewer:* The eighth question?

*Interviewee:* In this question, if an organisation use external consultant then the organization is mature. The consultant will make a good contract.

*Interviewer:* Now the first question of the third part?

*Interviewee:* It is again about leadership to whom?

*Interviewer:* What about the second question?

*Interviewee:* To improve the organisation, it can be achieved through themselves and from suppliers.

*Interviewer:* And next is the third question?

*Interviewee:* The third question is clear for me.

*Interviewer:* What about the fourth question?

*Interviewee:* The example of an organisation that manages the change is by involving suppliers to improve the process between the maintenance organization and the suppliers.

*Interviewer:* What do you think about the fifth question?

*Interviewee:* the fifth question is clear for me.

*Interviewer:* What do you think about the sixth question?

*Interviewee:* this is also clear. But may be you should consider to put this under the "People" part.

*Interviewer:* Now we move to the fourth part. It is the "People" enabler. What do you think about the first question?

*Interviewee:* I think suppliers are also can be considered in this "people" topic.

*Interviewer:* What do you think about the second question?

*Interviewee:* The second and the third question are clear for me.

*Interviewer:* What about the fourth question?

*Interviewee:* I think the stakeholders here can be defined between the users and the director. They have different interest. Therefore, maintenance department should have discussion and good communication between them.

*Interviewer:* Now let's move to the last part, it is the "Strategy". What do you think about the first question?

*Interviewee:* I think if we go back to understanding the scope, it has to be clear that which strategy? Is it the strategy following the director, or the strategy for the maintenance department itself? For the criteria of a mature organisation, it is important that the strategy of maintenance department has good collaborations with the strategy of the whole organisation.

*Interviewer:* What about the second question?

*Interviewee:* This is clear for me.

*Interviewer:* Now let's go to the third question. What do you think?

*Interviewee:* In this question, the strategies again back to the scope. When talking about the budget, it is the scope of the director of real estate or asset management. It is also important to have strategy about the technology they use. Moreover it needs to innovate the strategy.

*Interviewer:* Do you have something that you want to add?

*Interviewee:* Yes. It is possible to add a question about innovation strategy. It is about how the organisation can innovate the strategies to do more but using less money.

*Interviewer:* Thank you for your participation

*Interviewee:* Your welcome.

## **9. Key person from Building Services Research Institute**

*Interviewer:* Can you tell me something about your company?

*Interviewee:* this Company, if we called it in English, as a Building Service installation Research Institute. It is called ISSO. At ISSO we made series of guidelines, for public and private organisations about maintenance. For example, about sustainable maintenance for HVAC, we made a functional inspection method that is a problem driven method.

*Interviewer:* Now lets start with the first part of my assessment sheet. It is about the first enabler, Process and Services.

*Interviewer:* Now what do you think about the first question?

*Interviewee:* I think the multiple choices are clear for me. The distinctions between the levels are clear.

*Interviewer:* What about the second question?

*Interviewee:* I think for small organisation it is difficult to have the functional and financial standard. There is standard about the market value of a building. But for government, it is not common to value the building. For investor it is easy to value the building.

*Interviewer:* What do you think about the third question?

*Interviewee:* I think NEN is common to use as a standard.

*Interviewer:* What do you think about question four?

*Interviewee:* I think it is clear for me.

*Interviewer:* What do you think about question five?

*Interviewee:* I think it is clear for me.

*Interviewer:* Now let's discuss about the second part. It is the "Partnerships and Resources"

*Interviewee:* I think for option d, the words of "manage our resources" is not clear for me. What is the connection with maintenance?

*Interviewer:* what about question two?

*Interviewee:* I think for the multiple choices of d and e have too different gap.

*Interviewer:* what about question three?

*Interviewee:* I think it is similar with the previous question?

*Interviewer:* What about question four?

*Interviewee:* My opinion about setting the supplier's goals is that it is important to set the standard to the suppliers. For example is giving a bonus if suppliers give better results. I think for level d and e, it is important that there is collaboration between clients and suppliers. The more important is that the contracts should fit with the organisation.

*Interviewer:* what about question five?

*Interviewee:* I think this clear. The differences of every level are recognisable. The more important is that the sustainability can be aligned with the goal of the organisation.

*Interviewer:* What is your opinion for question six?

*Interviewee:* I think it is clear. But of course TCO/LCC is depend on the contract.

*Interviewer:* What do you think about question seven?

*Interviewee:* I think this question is clear. In my opinion, in procurement it is important that the organisation discuss with suppliers. Also the procurement regulation in public organisation is important. Not every organisation has a mature procurement policy.

*Interviewer:* What do you think about question eight?

*Interviewee:* I think for option a, every organisation has a contractual model. So it is impossible if they don't have specific contractual model.

*Interviewer:* Now lets go to the third part. It is about the Leadership. What do you think about the first question?

*Interviewee:* I think the option of b and c is not clear. Encouraging people has no clear structure process.

*Interviewer:* What do you think about the second question?

*Interviewee:* I think with the multiple choices like this, the people who fill in the assessment sheet can be bias. I think you need to give additional probing question, to ask the respondents about the proof why they think their organisation is already achieved this certain level.

*Interviewer:* What do you think about the third question?

*Interviewee:* I think it is clear.

*Interviewer:* What about the fourth question?

*Interviewee:* I think it is also clear.

*Interviewer:* What about question number five?

*Interviewee:* I think for the option d, you can add involving client and stakeholders in designing vision and mission. This will give opportunity to be an equal level between suppliers and maintenance department. Moreover, it will add more bonds between those organisations.

*Interviewer:* What do you think about question six?

*Interviewee:* I think it is clear for me.

*Interviewer:* We are now in the fourth part. It is the "People" enabler. What do you think about the first question?

*Interviewee:* I think it is clear for me.

*Interviewer:* What about the second question?

*Interviewee:* the second question is clear for me.

*Interviewer:* What about the third question?

*Interviewee:* I think you need to make the option d more clear. What do you mean with control all the employees? For option e, you need to explain more about control system.

*Interviewer:* Now lets move to part five. What do you think about question one?

*Interviewee:* The option c, for example it can use ISSO 101. It is inline the strategy that make easy communication between the asset manager or real estate manager and with the maintenance department.

*Interviewer:* What about the second question?

*Interviewee:* I think it is not clear for me. What does the maintenance policy means here? You need to explain more.

*Interviewer:* What do you think about the third question?

*Interviewee:* I think it is clear.

*Interviewer: Do you have another opinions about this assessment sheet?*

*Interviewee: I think you can make new questions about stakeholder management and procurement. First in stakeholder management you can ask, "which roles do the stakeholder management in your organisation?" The indication of a mature organisation is that the organisation is able to cooperate the stakeholders, within the operational level and on the strategic level.*

*Interviewer: Thank you for your participation in this interview.*

*Interviewee: Yes.*

## APPENDIX IV

### THE PROPOSED MATURITY SHEET

**Instruction:**

*Please choose only one answer that reflects with the current situation in your organisation the most.*

#### A. PROCESSES AND SERVICES

1. How does your organisation manage maintenance processes and services?
  - a. We have unclear procedures for delivering and services. Our people work according emerging needs in our organisation. Our success in maintenance processes is depending on individual performances.
  - b. We have basic standard procedures to deliver the maintenance process only for specific maintenance services. We plan our maintenance services based on the previous project success. Our project estimations are based on the expert knowledge.
  - c. We have standard maintenance processes that are consistent and integrated for most all maintenance services. Our management can track the progress of our maintenance services. Our projects estimations are based on our organisation standards.
  - d. We have maintenance processes that are integrated with our mission of organisation success. Our management use the data and involving stakeholders to make decisions.
  - e. We have processes to evaluate our effectiveness and efficiency of delivering maintenance services. Our goal is to improve our maintenance performances.
  
2. How does your organisation perform an object assessment?  
*(Here, the object assessment is an assessment that is conducted to value the building objects within the aspects of functional, financial)*
  - a. We don't have specific standards (e.g. accounting standard for building financial value) for the assessment. Our assessment are based on emerging needs and driven by the individual.
  - b. We use our standardized procedures to value the building objects of which the bigger scale maintenance services will be performed. We use our own standards.
  - c. We use national standardised procedures to assess the building objects for most all scales of maintenance services.
  - d. We value the building objects, compile the data, and then we use and share it for all level in our organisation management and for our stakeholders.
  - e. We recognise our strengths and weaknesses in valuing the building objects and learn from it. We always improve our processes in valuing the building objects.
  
3. How does your organisation perform a condition assessment?  
*(Here, the condition assessment it is an assessment for the technical aspects of building components)*
  - a. We don't have specific standards (e.g. NEN 2767) for the assessment. Our assessment are based on emerging needs and driven by the individual.
  - b. We use our standardized procedures to value the building objects of which the bigger scale maintenance services will be performed. We use our own standards.
  - c. We use national standardised procedures to assess the building objects for most all scales of maintenance services.

- d. We value the building objects, compile the data, and then we use and share it for all level in our organisation management and for our stakeholders.
- e. We recognise our strengths and weaknesses in valuing the building objects and learn from it. We always improve our processes in valuing the building objects.

4. How does your organisation supervise the delivery of maintenance activities?

*(Here, supervising maintenance activities means that the organisation monitors the maintenance processes from the planning phase to the execution phase)*

- a. We supervise our maintenance process when it is needed and mostly initiated by individual effort.
- b. We have standard procedures for supervising maintenance (e.g. standard procedures defined by our own organisation). We mostly supervise the visible/bigger maintenance activities.
- c. We supervise all of the maintenance activities based on the standard procedures we have.
- d. We supervise all of the maintenance activities and we involve suppliers to do it. We want to add value for our organisation and get insights from the stakeholders by working together in supervising our maintenance services.
- e. We evaluate our efficiency and effectiveness of our supervising activities. We want to learn from our strengths and weaknesses in order to always improving.

5. How does your organisation respond to client's feedbacks?

- a. We response to feedback when it is emerges. We do not have clear procedures or systems to response to feedback.
- b. We have established systems (e.g. forms, questionnaires, on line feedback, etc.) to response the feedbacks from clients. We ask feedbacks from our bigger clients to know their satisfaction levels and we respond some of their feedbacks.
- c. We are consistently using our standardised systems to response feedbacks from clients. We ask feedbacks from all of our clients and respond most of their feedbacks.
- d. We use the data from client's feedbacks to make decisions in our organisation management. We also ask feedbacks from other stakeholders in order to always innovate in our maintenance services.
- e. We evaluate our systems and our responses to client's feedbacks. We review its strengths and weaknesses. We always improve our systems to respond the feedbacks.

## **B. PARTNERSHIPS AND RESOURCES**

1. How does your organisation manage partnerships and resources of the organisation?

- a. We don't have procedures to manage our partnerships and resources. We match our needs and our available resources only when the maintenance services have to be delivered.
- b. We documented our recourses to fit with the important maintenance processes/activities. We establish partnerships with our important clients, suppliers, and stakeholders.
- c. We plan our resources to meet with the overall process for the specific needs in the organisation. We develop our partnerships with all of the clients, suppliers, and stakeholders.
- d. We are able to manage our resources to fit and support the success of entire organisation activities. Our partnerships with clients, suppliers, and stakeholders are well defined, and we are seeking for innovation in partnerships model.
- e. We learn from our strengths and weaknesses to improve our partnerships and resources management.

2. How important is technology (e.g. IT system) for your organisation in providing maintenance services?

- a. We use basic technology (e.g. Microsoft office) to support our maintenance processes.
- b. We use specific IT system to support the specific maintenance processes.
- c. We use an integrated IT system that supports all of our maintenance processes.

- d. We use IT systems applicable for delivering maintenance services that are in line with the organisation's management systems. We are able to incorporate data from our clients, suppliers, and stakeholders.
    - e. We have very well integrated IT systems and we evaluate its efficiency and effectiveness to seek improvement.
3. How does your organisation manage the collaboration with the maintenance markets?
  - a. We manage our collaboration with the maintenance market when it is needed. The collaboration is developed depend on individual willingness.
  - b. We are engaged with the most important and visible maintenance markets and we are able to develop mutual collaboration. We plan our meeting frequently.
  - c. We are able to manage our collaboration with most all of the maintenance markets. Our relationships are consistent.
  - d. We manage our collaboration with all maintenance market to support the success of the management of our organisation. We are also involving our clients and stakeholders in managing the maintenance markets.
  - e. We evaluate our strengths and weaknesses in managing our collaboration with the maintenance market and improve it.
4. How does your organisation set the supplier's goal to deliver maintenance services?
  - a. We set the supplier's goals immediately when they want to perform the maintenance tasks.
  - b. We have defined standard goals for the suppliers. The goals are clearly stated in the contract for specific/visible maintenance services.
  - c. We have consistent and standardised goals for the suppliers. The standard goals are integrated and clearly stated for all maintenance services.
  - d. We set the supplier's goals together with clients and suppliers. We set the supplier's goals that in line and integrated with the organisation's management goals.
  - e. We have well defined supplier's goals. Therefore we evaluate its efficiency and effectiveness of the goals. We learn from it and improve it.
5. How does your organisation manage the organisation's resources in sustainable ways?
  - a. We manage our resources but we don't think that managing it in sustainable way is necessary.
  - b. We have established procedures to manage our organisation resources in sustainable ways for specific needs.
  - c. We have standardised and consistent procedures to manage our resources in sustainable ways for all area of our organisation.
  - d. We manage our resources in sustainable ways to support the success of our organisation management. We are involving our partners, clients, and stakeholders to support it.
  - e. We have excellent management for our resources that are integrated and organised. We evaluate the strengths and weaknesses, and seeking for improvement.
6. How does your organisation incorporate TCO/LCC?
  - a. We don't think that the TCO/LCC is applicable to use in our organisation.
  - b. We use TCO/LCC only for appropriate contract (e.g. DBM contract) and specific circumstances.
  - c. We have standardised and consistent procedures to use TCO/LCC and implement it in all our maintenance services.
  - d. We use TCO/LCC for all our maintenance activities and make sure that it is inline with the management of our organisation.
  - e. We evaluate the efficiency and effectiveness of using the TCO/LCC in our organisation; we learn from it and improve it.
7. How does your organisation procure maintenance services?
  - a. We perform procurement though we don't have standardised process and procedures. Our methods are matching with the emerge condition.

- b. We establish procurement procedures for specific maintenance activities. Our procurement processes are mostly delivered for bigger/visible maintenance projects.
  - c. We have procurement process and procedures that are standardised and consistent for all types of maintenance services and projects.
  - d. Our decisions in procurement process are inline with our organisation's management perspectives. We involve our clients, suppliers, and stakeholders to support our procurement processes.
  - e. We review our procurement processes and improve it to focus on its effectiveness and efficiency.
8. How does your organisation apply contractual models for maintenance services and activities?
- a. We set contracts for maintenance activities nearly the ended of the delivery time. We don't have specific contractual models for different maintenance activities.
  - b. We have standard contractual models for specifics/visible maintenance activities.
  - c. We have consistent and standardised contractual models for all types of maintenance activities.
  - d. We have contractual models that are defined together with our clients about what are the appropriate maintenance strategies that will be provided by us. Our contractual models are supporting the mission of our management organisation. We are always innovating our contractual models.
  - e. We have excellent contractual models for different maintenance strategies; and we evaluate its strengths and the weaknesses. We always seek for improvement.

### C. LEADERSHIP

#### 1. How do you consider the Leadership in your organisation?

- a. Our leaders are having difficulty in establish vision and mission for the people in the organisation. Our leaders cannot become role models, and having difficulty to manage the maintenance processes. People are not encouraged to follow our organisation's value.
- b. Our leaders set vision and mission. Our leaders act as role models following our organisation's value. Our leaders encourage people to apply our mission to focus on our maintenance processes.
- c. Our leaders are able to plan our processes and manage the people in our organisation to apply organisation mission for all processes in the organisation.
- d. Our leaders are able to manage the strengths and competences of our organisation and make sure that the value is inline with the value of our management organisation.
- e. Our leaders evaluate our strengths and weaknesses and improve it.

#### 2. How do the leaders of your organisation make sure that the organisation is continuously improving?

- a. Our leaders do not set the plan for organisation improvement. Improvement in our organisation is based on individual effort.
- b. Our leaders establish guidelines and plan to make sure that our organisation to always improve only for the specific/visible areas.
- c. Our leaders set clear strategies that consistent and standardised to improve our organisation in all areas.
- d. Our leaders make sure that our improvement is in line with our organisation management. We are involving clients and stakeholder's opinions in order for the improvement and innovation.
- e. Our leaders monitor and review our organisation's plan for improvement. We always seek for the most effective and efficient improvement.

#### 3. How do the leaders in your organisation encourage integrity, transparency, effectiveness and legality rules?

- a. Our leaders cannot promote integrity, transparency, and effectiveness in our organisation because of unclear legality rules. There are risks of fraud in our maintenance processes.

- b. We have clear policies and legality rules toward transparency, integrity, and effectiveness only for our maintenance processes. People understand and follow the legality rules.
  - c. Our leaders bring the spirit of transparency, integrity and effectiveness into all processes and aspects of our organisation. Our rules and regulations are consistent and standardised.
  - d. Our leaders are working together with clients and stakeholders to create the environment of transparency, integrity, and effectiveness. The legality rules are communicated well and always innovated.
  - e. The state of legality rules, transparency, integrity, and effectiveness in our organisation are very well integrated. Our leaders evaluate and improve it.
4. How do the leaders in your organisation manage the change and flexibility?
- a. Our leaders manage the change in the organisation when it emerges and needed. Our leaders are not flexible.
  - b. Our leaders have clear guidance to manage the changes and flexible for specific primary activities and areas.
  - c. Our leaders are able to manage the change and flexibility through standardise and consistent strategies (e.g. PDCA (plan, do, check, act)) for all activities and areas.
  - d. Our leaders make sure that our changes are supporting the success of our organisation management. We are flexible and involve partners, clients, and stakeholders to encourage positive changing.
  - e. Our management of change and flexibility are well integrated. Therefore, our leaders review the change and flexibility in our organisation and always seek for improvement.
5. How do the leaders in your organisation set the vision and mission, and incorporate people in delivering it?
- a. Our leaders have difficulty to set the vision and mission. The people in our organisation cannot recognise what the mission and vision are.
  - b. Our leaders are able to set the vision and deliver it in form of mission for the specific/visible maintenance processes. People recognise it.
  - c. Our leaders set the vision and mission for all aspects in the organisation and make sure that the people understand and apply it into our organisation.
  - d. Our leader set the vision and mission that support the success of all levels in our organisation management. We make sure our clients and stakeholders understand it.
  - e. Our vision and mission are very well integrated in our management system. Our leaders review and improve it.
6. How do the leaders of your organisation developing the human resources?
- a. Our leaders develop human resources to match with the needs. We don't measure the competence and skills of the people in our organisation.
  - b. We have system established (e.g. career path) to develop the capabilities of our human resources. The competence and skills of the people are recognised by our leaders. Our leaders focus on development for the employees of specific/visible areas.
  - c. Our leaders set the procedures to develop human resources that are consistent and standardised. People of all areas and levels are trained to improve their skills and capabilities. Our leaders focus on the development of skills and competence of the people of all areas.
  - d. Our leaders train the people in our organisation to support the success of organisation's management. The people's performances are measured and integrated with the career development.
  - e. We have excellence procedures and process to develop our human resources. Our leaders evaluate it and always seek for improvement.

## D. PEOPLE

### 1. How does your organisation valuing the people?

- a. People are important for the organisation but the skills and competence of the people are difficult to recognised. Success of the organisation is depending on the individual effort.
- b. We have procedures to recognise the skills and competences of people in our organisation.
- c. We have consistent and standardised procedures to recognise and to manage the skills and competences of our people. We have people development program that in line with the maintenance department career path.
- d. We measure the competences and skills of our people and integrate it with the career development in our organisation management.
- e. The management of the people in our organisation are well integrated. We evaluate the systems and seeking for improvement.

### 2. How does your organisation consider innovation and creativity?

- a. We have no encouragement to be innovative and creative in our organisation.
- b. We are encouraged to be innovative and creative, mostly for the visible/bigger maintenance activities.
- c. We have standardised procedures that encourage innovation and creativity for all aspects and activities in our organisation.
- d. We are encouraged to be creative and innovative for all processes that support the success of our integral organisation management.
- e. We review and evaluate our output of the innovation and creativity. We are seeking for the innovations that bring the most efficient and effective processes. We know our strengths and weaknesses and improve it.

### 3. How do you consider control in your organisation?

- a. We have unclear system to control the skills and competence of the people and we use it only when crisis happened in the organisation.
- b. We have procedures established (e.g. reward systems, monthly evaluation) to control the quality and competence of the people. We are able to control the people and their performances only for the visible/specific maintenance activities.
- c. Our system to control the people is standardised and consistent. People are responsible for their own products & qualities, more competitive, and able to adapt in the new ways of working. Our control system covers all levels and activities in our department.
- d. The processes of controlling the people in our organisation are well defined. People are able to develop the collaboration and working together with stakeholders. We are able to measure the competences to control the output of maintenance. Our control systems are aim for the success of organisation management.
- e. We have well integrated control systems. We evaluate our control systems and improve it.

### 4. How does your organisation consider managing the stakeholders?

- a. We manage our stakeholders when we need it.
- b. We have awareness and procedures established (e.g. weekly meeting, monthly meeting) to manage our relationship with the stakeholders. We maintain the relationship with the stakeholders to control the quality of our primary maintenance activities.
- c. We have standardised procedures and system to manage the stakeholders. We maintain the relationship with our stakeholders to control the quality of all maintenance activities.
- d. We have well defined processes of managing the stakeholders. We are able to working together with stakeholders in order to support the goals of the organisation management.
- e. We evaluate our approach in managing our stakeholders and seeking improvement for the most efficient and effective ways.

## E. STRATEGY

1. How does your organisation considering strategy?
  - a. We have no planned strategy, but it will emerge when it is needed.
  - b. We have clear strategies in our organisation. Our strategy aims to control our primary process and our primary maintenance activities.
  - c. We have standardised and consistent strategies. Our strategies are applicable for all processes and activities in our organisation.
  - d. Our strategies are integrated and support the success of our organisation management. We always innovate to seek the best strategies.
  - e. We evaluate our strategies. We know our strengths and weaknesses and we improve it.
  
2. How does your organisation considering maintenance policy?
  - a. We don't have clear maintenance policies. We use it when necessary.
  - b. We established standardised maintenance policies to guide our maintenance process. We have maintenance policies available only for visible/primary maintenance processes.
  - c. Our maintenance policies are consistent and standardised. It applied for all maintenance processes.
  - d. Our maintenance policies are well defined, integrated, and supports our organisation management.
  - e. We evaluate our maintenance policies. We always seek for improvement for the most effective and efficient policies.
  
3. How does your organisation considering maintenance strategy?
  - a. We don't have awareness towards the importance of make different maintenance strategies (e.g. planned preventive maintenance and responsive maintenance). Our maintenance strategy used is based on our needs. We have no clear maintenance plan.
  - b. We have maintenance strategies that are set for different types of maintenance services, only for the visible/primary scale of maintenance projects.
  - c. We have maintenance strategies that are consistent and standardised. Our different strategies of planned preventive maintenance and responsive maintenance cover all scales of maintenance.
  - d. Our maintenance strategies are well defined. The types of our maintenance strategies are aim to support our organisation management. We always innovate to seek what maintenance strategies that are appropriate to use.
  - e. Our maintenance strategies are integrated with the management system. We evaluate the efficiency and the effectiveness in order to improve it.