Towards an Enterprise Performance Management Solution

A method to design and implement enterprise performance management

Master thesis
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IT-eye

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Master thesis Ruben Span | Towards an Enterprise Performance Management Solution
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Page | 4

Management summary

Motive for the research

Fundeon came to life after the merger of Bouwradius and SBW. Because of this new situation, difficulties arose managing the new company`s performance. IT-Eye was approached to help solving these problems. Unfortunately, IT-Eye did not have a (standard) approach to attack these problems. It soon became clear that companies generally lack guidance when applying enterprise performance management (EPM) to improve their alignment of business processes with their business strategy and to enhance their ability of measuring performance. In addition, also literature did not provide an all-encompassing methodological approach for EPM design and implementation.

Main recommendations

To help solving the indicated problems, this research proposes a method to help designing and implementing EPM. This method consists of phases, steps, activities supporting these steps, and methods and techniques. Although the proposed method can be made more pragmatic, it gives some guidance when applying EPM. This includes the statement that EPM must be designed and implemented in an iterative way, having a steering committee managing the company`s strategy for EPM. Amongst others, this EPM strategy contains decisions about the inclusion of business process redesign and changes in the organizational structure.

Motivation

The method was developed by combining literature with an analysis of current practices. The latter was done by conducting five interviews with experts in the field. The resulting solution design was evaluated with the help of an interactive workshop at Fundeon. To increase the justification of the proposed solution, the research process by itself was also evaluated.

Consequences

➢ The method can be used as guidance to solve the current problems at Fundeon.
➢ The method must be applied in practice to validate its usefulness.
➢ Deliverables should be appointed to each of the steps and/or phases of the method to increase its usefulness.
➢ The development of the method is an iterative process, which requires an extension of the analysis of current practices.
➢ The evaluation should be done on a larger scale, including participants from different branches and backgrounds.
➢ An EPM maturity model should be made to help analyzing the business and to serve as a tool to develop a company`s EPM strategy.

Preface

Dear reader,

Thank you for taking the time to view the result of months of hard labor. Several nights, weekends and drinks were sacrificed in other to make it to the end of my study period. I must admit that some hurdles had to be taken to come this far. For example the search for two good supervisors took quite some time. Fortunately, it all turned out well by having Romana Aziz and Pascal van Eck as my supervisors from the University of Twente. I would like to thank them for their support and useful feedback during the whole project.

When I started the project, I hoped to quickly produce a method to attack the problems at Fundeon and then apply the method in practice. During my literature review it soon became clear that this plan was impossible to execute. Similar projects can take up to two years, where I had only six months without a clear starting point. Also the development of the method itself appeared to be much more complicated then I thought at the beginning of the project. Therefore my research had to be limited to building the method and testing it via the help of an interactive workshop at Fundeon. Hereby I would like to thank the people at Fundeon for their helpful input during this workshop.

Without the help of IT-Eye, this project would not have been possible. Mike van Alst, thank you for being my external supervisor and helping me during the process. Special thank goes to Tim Pinchetti for being my unofficial second supervisor at IT-Eye giving me useful feedback. I would like to thank the rest of IT-Eye for giving me this opportunity, supporting me and providing a good atmosphere to work in.

Of course, also family and friends must be thanked for being there when I needed it. Finally, I would like to thank the experts I have interviewed. I want to thank them for their time, openness and interesting views on performance management. Their input was crucial for this project`s success.

I hope that you, as a reader, will gain some useful insights when reading this master thesis. Good luck applying enterprise performance management in practice, and may the method be with you!

Best regards,

Ruben Span

July 19th 2009

Table of Contents

List of Figures

List of Tables

Acronyms

BI	Business Intelligence
BPM	Business Performance Management (synonym for EPM)
BPR	Business Process Redesign
BSC	Balanced Scorecard
CFO	Chief Financial Officer
CIO	Chief Information Officer
CMM	Capability maturity model
COTS	Commercial off-the-shelf
CPM	Corporate Performance Management (synonym for EPM)
CSF	Critical Success Factor
EFQM	European Foundation for Quality Management
EPM	Enterprise Performance Management
EPMS	Enterprise Performance Management System
ERP	Enterprise Resource Planning
ETL	Extraction, Transformation, and Loading
ICT	Information and Communication Technology
IPMS	Integrated Performance Measurement System
IS	Information Systems
IT	Information Technology
KPI	Key Performance Indicator
OM	Observation Model
PDCA	Plan, Do, Check, Act
PDSA	Plan, Do, Study, Act (synonym for PDCA)
PM	Performance Measurement
PMG	Performance Measurement Grid
PMS	Performance Measurement System
PoC	Proof of Concept
PPS	Performance Pyramid System
SME	Small and Medium Enterprises

1   Introduction

Within this first chapter of the thesis an introduction of the conducted research is given. Its purpose is to provide insight in the background of the research, making clear what the 'business case' is all about. Whereas different definitions exist of the term Enterprise Performance Management, it must be noted that the used definition within this thesis will be made clear in the literature review (chapter 3).

This chapter starts with the problem description, explaining the original reason for the conducted research (paragraph 1.1). As a result, a problem statement is defined (paragraph 1.2), followed by the objective of this research (paragraph 1.3). An explanation is provided to show how this research adds value to both literature and practice (paragraph 1.4).

Within the second chapter the complete research will be described in a more comprehensive way. The structure of this thesis will become clear at a later stage (paragraph 2.2: Research methodology), but one can already see that this thesis is structured linear to how the research was conducted. A literature review will be given (chapter 3), followed by an analysis of current practices (chapter 4). These two are combined to come to the design of the solution (chapter 5). Next, the solution design is evaluated (chapter 6) and conclusions are drawn (chapter 7).

1.1   Problem description

Fundeon is a knowledge centre which came to life after the merger of Bouwradius and SBW in 2006. It operates as the chain between organizations from the building and infra sector, and the technical and vocational training. Since 2007 a new enterprise information system has been set up. Although the company formulated several business objectives, it did not set indicators which should notify the management whether or not these objectives are met. With the arrival of the new enterprise information architecture, a good opportunity has been given to introduce more measurement points and elaborate on the current business objectives by linking them with appropriate measurements.

Next to this opportunity, there is a problem with the current way in which the strategy is communicated within Fundeon. For example the IS manager did not know about the spearheads of Fundeon`s policy. Clearly, the strategy of Fundeon was not visible enough for its own employees.

Another problem is that Fundeon thinks there is a weak spot within the organization they cannot recover with the current (limited) measurement methods. This implicates that current performance measurement methods are not accurate enough to find inefficiencies within business processes.

An important problem is the lack of management decision justification. Little insight is given on which management information was available when decisions were made and to which extent these decisions were made on a rational basis.

The last problem Fundeon faces is that their sponsors, including representatives of the branch they are working with, want an elaboration on the effects of the money they have put in the knowledge centre. Within the current situation, little overview of the company`s performance can be awarded to the shareholders in order to keep them satisfied.

To be able to find a solution for these problems, Fundeon hired IT-Eye. The problem within IT-Eye herein lies that it does not have a (standard) approach to attack these problems and thus has to

discover how it best can design and implement a new performance measurement or management system.

1.2 Problem statement

As a result of the problem description, the problem statement is formulated as:

"Companies lack guidance when applying enterprise performance management to improve the alignment of business processes with the business strategy and to enhance the ability of measuring performance."

1.3 Objective

The objective is *"to come to a method towards the design and implementation of an enterprise performance management solution, thereby improving the alignment of business processes with the business strategy and enhancing the ability of measuring performance*."

This method must consist of steps to be taken when designing and implementing an EPM solution and a set of techniques and methodologies which are needed to execute these steps. The resulting method must be independent of the technology to be used when implementing the solution.

This objective should tackle the problem of IT-Eye, and thus Fundeon as well, to come to a method to clarify and communicate the company`s strategy and to monitor business processes. The next step of exploring the applicability of an enterprise performance management system should help the company amongst others in decision making and automating management processes. This should envision new opportunities for the company to further more improve performance.

1.4 Relevance

Enterprise Performance Management (EPM) is a topic in the business intelligence area that is receiving a great deal of attention. It was recently ranked as one of the top ten technology trends that CIO's should have on their radar [AF08], and considered useful to "keep a jump ahead of the competition" [Sch04].

According to Lingle and Schieman [LS96] organizations using balanced performance measurement systems as the foundation for management perform better than those that do not. Therefore, it should be valuable for companies to gain knowledge about the introduction of an EPM system and to gain understanding of the properties this system must have for it to be executable and successful.

Next to this practical relevance, there is a gap in literature concerning EPM. Currently, no all-encompassing methodological approach for EPM design and implementation exists.[1] And as Dresner [Dre08] denotes, one can approach EPM in multiple ways whereas different business cases require different approaches. Although this statement could be interpreted as a restriction on the legitimacy of a methodological approach for EPM design and implementation, variations can be incorporated within the solution to encompass this need for different approaches.

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[1] A literature study has been conducted, using search engines in the likes of IngentaConnect, Scopus and Google Scholar wherein no such method has been recovered

Current EPM approaches in literature include the BPM framework by Frolick and Ariyachandra [FA06], and the BPM lifecycle by Zeng et al. [ZLDC06] (see chapter 3). These frameworks are set up at a high-level and have great similarities with the PDCA cycle from Deming [Dem86]. Therefore they lack detail and have a main focus on the continuous improvement aspect of EPM implementation. Summarizing, the present EPM frameworks are little specific for EPM development and are less practical in supporting the design and implementation of EPM solutions.

This thesis tries to extend literature by providing a method to help design and implement an EPM solution, thereby delivering insight into the activities and phases that take place when developing an EPM solution. By describing this method, the gap in literature should be reduced.

2   Research design

This chapter describes the research as it is conducted. It starts with the research questions which are based upon the problem statement and the objective of the research. Next, the methodology of the research is described to clarify how this project attempts to answer the research questions. As a consequence of the methodology a conceptual framework has been developed. This framework can be seen as the proposition of this study and is used to help structuring the research. Next, the data sources of evidence are described. It shows how data is collected. The research procedures show the case study protocol used to execute the data collection. As elaborated in this chapter, a multiple-case design is used for this research. This entails interviews of five experts at different companies. In paragraph 2.6 these cases are described.

2.1   Research questions

Based on the problem statement and objective, the main research question is formulated as follows:

What can be a method towards the design and implementation of an enterprise performance management solution, and what are the properties of this solution?

To answer this question, several sub-questions have been defined:

1) What is the current state of affairs in literature, regarding enterprise performance management (EPM)?
2) What are constraints one has to deal with when designing and implementing an EPM solution in practice?
3) What are the properties of an EPM solution in practice?
4) What phases can be distinguished within the design and implementation process of an EPM solution in practice?
5) What steps or activities can be executed when designing and implementing an EPM solution in practice?
6) What methods and techniques can be used to support these steps or activities in practice?

2.2   Research methodology

The first part of this project consists of a descriptive research wherein the foundation of the solution is laid by the use of scientific literature (chapter 3). After the description of the current literature on performance measurement systems and enterprise performance management models and frameworks, an analysis is made of the current practices (chapter 4). This analysis must help to gain understanding on how EPM is approached in practice as needed to develop a method to design and implement EPM. To do this analysis, the choice has been made to use a holistic multiple-case design. According to Yin [Yin92] holistic multiple-case design is the analysis of the same or similar situations in different organizations. Within this research it entails the analysis of the approach of EPM design and implementation by interviewing five experts from different companies. Since each expert has his own vision and operates in his own setting, each of these interviews can be interpreted as a different case.

The outcomes of both the literature study and the analysis of the current practices are combined to come to a method to design and implement an EPM solution, i.e. the design of the solution (chapter 5). After the creation of this method, it is evaluated by conducting a workshop at Fundeon (chapter

6). The outcome of this workshop results in the modification of the proposed method. The developed method has implications for practice and literature (chapter 7) which helps solving the problem as stated before. The used methodology can be recovered from Figure 1.
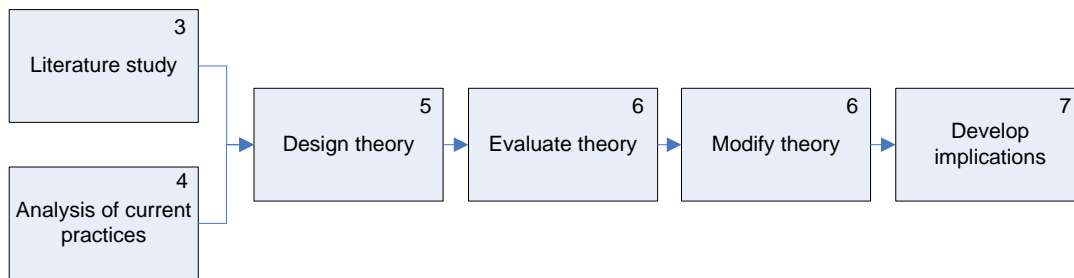
Figure 1 - Methodology

2.3   Study propositions: a conceptual framework

On the basis of the research questions a conceptual framework has been developed. The idea of developing such a framework comes from the sourcebook for qualitative data analysis of Miles and Huberman [MH94]. At a later stage the framework will be used to structure qualitative data and to build the method around. The developed framework is shown in Figure 2.
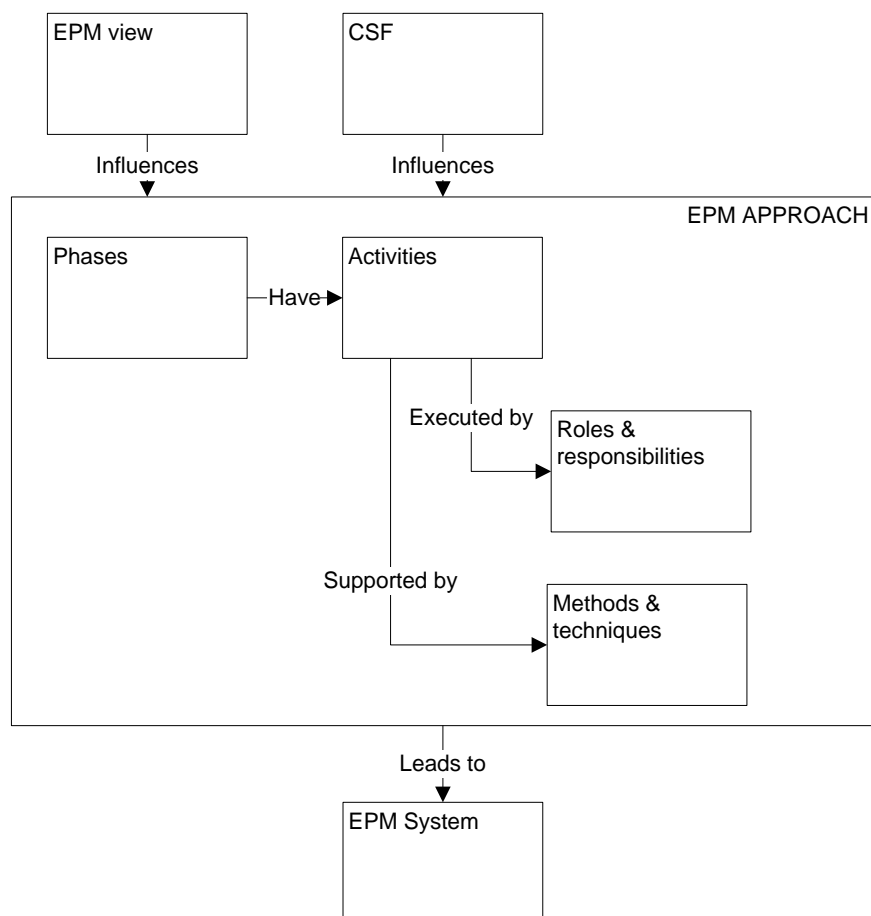
Figure 2 - Conceptual EPM approach framework

The framework consists of three parts, which are also used to structure the chapters within this thesis. The upper part ('EPM view' and 'CSF') are the factors which influence the content of the approach. The approach itself consists of 'Phases' which on its turn has 'Activities'. These activities are executed by persons having different 'roles & responsibilities' and are supported by the use of several 'methods & techniques'. The contents of these four boxes combined make the method to design and implement an EPM solution. The last part of the framework is the 'EPM system' itself, which is the result when the method has been executed.

The boxes of this framework are based on the project`s research questions (see paragraph 2.1). The box 'EPM view' and 'EPM system' are incorporated to get insight into the answer to the question '*What are the properties of an EPM solution in practice?',* and to understand what an EPM system could look like in practice. The box 'EPM view' includes statements about how the company should be organized and how EPM should support this management method. This box also includes statements about the way EPM should be scoped. The box 'CSF' (critical success factors) is incorporated to answer the question '*What are constraints one has to deal with when designing and implementing an EPM solution in practice?'.* The question '*What phases can be distinguished within the design and implementation process of an EPM solution in practice?*' is answered by the box 'phases'. The box 'activities' entails the high-level activities which are performed when conducting EPM, such as project management and change management. It provides answers to the question '*What steps or activities can be executed when designing and implementing an EPM solution in practice?*'. It has activities executed in a specific order (steps), activities executed within specific phases and activities executed during multiple phases. The box 'methods & techniques' copes with the question '*What methods and techniques can be used to support these steps or activities in practice?*' The box 'roles & responsibilities' has been added to summarize the (group of) persons to be involved in an EPM project and the responsibilities of these persons for different activities within EPM.

2.4   Data sources of evidence

As mentioned before, the method is created by combining literature and current practices. The literature study has been conducted by gathering and analyzing journal papers, conference papers and scientific books. To be sure most of the literature about this subject was gathered, keyword search and forward and backward reference search was applied by using diverse search engines in the likes of IngentaConnect, Scopus and Google Scholar. The approaches of Webster and Watson [WW02] and Levy and Ellis [LE06] were used to conduct the literature review and to validate the quality of found literature by focusing on top journals and conferences.

The analysis of current practices is done by interviewing five experts in the field. To ensure the corroboration of evidence, documents of the experts were used in the form of PowerPoint slides, whitepapers, leaflets and books. The next paragraph (2.5) will elaborate on this by summarizing the research procedures.

To develop the model of an EPM system, the information from the different cases (experts) are extended by including EPM models from the three leading vendors of EPM systems (according to Gartner research [CRD08]). These models are extracted from the websites, whitepapers and brochures of the vendors. In addition, the training 'Oracle EPM Hyperion Planning' has been attended to get insights of EPM applications in practice.

2.5   Research procedures: case study protocol

Within the analysis of current practices the expert interviews are leading. The questions used in these interviews are derived from the literature study and the conceptual framework from paragraph 2.3. The questions can be recovered from Appendix A: Interview questions.

As with the conceptual framework, the case study protocol is based on the sourcebook for qualitative data analysis of Miles and Huberman [MH94]. The interviews were approached in an open way with a relatively passive interviewer. In this way as much information as possible was gained from the interviews and the objectivity of the interview results can be assured. For this reason the question list was primarily used as a reference guide, i.e. not all of the questions from this list were literally asked.

The interviews were recorded and then transcribed and analyzed with the help of a text coding program. The transcriptions were coded, categorizing text pieces using a list of nodes. The used 'node list' can be recovered from Appendix B: Node list to structure interviews results. The pieces of text at each of these nodes were used to summarize the interviews per topic, serving as the backbone for the analysis of the current practices.

2.6   Multiple-case design: five experts

As explained in paragraph 2.2, this research uses five cases to analyze current practices. This paragraph describes the different backgrounds of the experts, thus summarizing the different cases used within the analysis of current practices. An additional summary of the cases can be found in Appendix C: Additional interview data.

The interviews with the experts were held between February 24th and March 13th 2009. Each interview took between 1 and 1 ½ hour. The interviews were recorded with agreement of the respondents.

2.6.1   Respondent 1

The first case entails a small, very specialized consultancy company working with EPM for over fifteen years. It has implementations at both small and large companies, with no specific branch focus. The size of the projects also differs. For example only the help of this company is required at certain stages of the EPM project. The company has worked with forty to fifty clients from which fifteen to twenty are guided for the duration of the full EPM project. These types of projects normally have a time span of over a year.

The expert has a lot of experience with EPM. He has written books about the subject, teaches classes about it at the university and is director of his own company. His role is that of a coach within an EPM project, i.e. instead of taking over the steering wheel himself, he goes to a company and tries to get the company manage itself in a better way.

2.6.2   Respondent 2

The second case is about a small company which provides advice and implementation services for EPM. It is specialized in the domains ranging from strategic finance and strategic planning towards operational planning, financial consolidation. Its client base includes large international organizations which are quoted on the stock exchange. The company is part of an integrated European EPM

consulting network, which collaborates on "thought leadership, best practices, training and real life experiences to create a unique perspective on the successful implementation of EPM solutions."

The expert is director of the company and has many years of experience with EPM. This includes experience gained within his current company and his previous jobs at a large international consultancy firm and a large software vendor.

2.6.3   Respondent 3

The third case entails a large international firm in consultancy, ICT and outsourcing. Its client base is diverse, but mainly focused on the top eighteen organizations in the finance & public sector. The firm does the whole EPM project, i.e. from developing the strategy till the actual implementation of an EPM solution. When executing an EPM project, personnel from different departments are put to action. For example the strategy is developed within a different part of the company than the implementation of the actual EPM solution. The duration of an EPM project executed by this company differs a lot. It can take two to three months or, when making a complete environment, two to three years.

The expert is partner at the firm and describes himself as an expert on management inquiries, consultancy for EPM, BI, data warehouses, ETL and decision support. He has done this job for approximately ten years at this firm. He sees himself as an architect of the EPM project, i.e. setting out the big lines and setting up quality assurance.

2.6.4   Respondent 4

The fourth case deals with a large international IT-service provider. It has a large client base, whereby the respondent has done two complete EPM projects at the private sector and five at the public sector. About thirty percent of all the sales is retrieved in the area of management information and EPM at the public sector. This respondent also denotes that his EPM projects differ a lot in size and duration.

The expert is senior organizational advisor at this firm for the duration of five and a half years. He is also a university teacher and has written a book about the subject.

2.6.5   Respondent 5

The last case concerns a medium sized IT service provider, specialized in performance management, system and network management, system development and maintenance, and output management systems. Its client base is very large, including all large Dutch companies and two hundred large companies outside the Netherlands. Performance management is one of the four business units of the company.

The expert is director and owner of the company. He founded his company in 1990 and has experience with performance management since 1995.

3   Literature review

Within this chapter an elaboration is given on the current state of affairs in literature regarding performance measurement systems and enterprise performance management (EPM) systems. Literature about both types of systems is reviewed, because performance measurement is intertwined with performance management [Leb95].

Whereas one can interpret the term enterprise performance management in different ways, this chapter starts with an explanation of the term as it is used within this thesis (paragraph 3.1).

The remaining part of this chapter is structured according to the three parts of the conceptual framework. Paragraph 3.2 describes the system models available in literature. It describes the performance measurement system models and the functions an EPM system must have. Only the functions of an EPM system are mentioned, whereas no holistic EPM model was found in literature. (see paragraph 1.4)

Paragraph 3.3 describes the factors influencing the EPM method. This entails the critical success factors (CSF) found in literature and preliminary theory on the view on EPM. The CSF`s are the factors one has to deal with in order to increase the likelihood of successful EPM introduction. These factors should be covered by the activities within the proposed method.

Paragraph 3.4 gives a literature review on enterprise performance management and performance measurement system models and frameworks. Comparisons are provided to emphasize the similarities and differences of these models and frameworks, thereby indicating their usefulness for the development of the EPM design and implementation method.

At the end of this chapter (paragraph 3.5) a conclusion is provided, reflecting on the current state of literature regarding EPM. Hereby the first research question *'What is the current state of affairs in literature, regarding enterprise performance management?'* is answered.

3.1 Definition of Enterprise Performance Management

In order to define performance measurement, one must first agree on what performance is. Performance is used in many different contexts with as many different uses of the term. [FBJ07] Neely et al. [NGP95] define performance as the efficiency and effectiveness of action, whereby a performing business is the one which takes efficient and effective actions. According to Lebas [Leb95], performance is the potential for future successful implementation of actions in order to reach the objectives and targets. This definition views a performing business as the one that will achieve the objectives set by the managing coalition, not necessary the one that has achieved the objectives. Within this research, the combination of both definitions is used to define performance:

Performance is the efficiency and effectiveness of action, whereby a performing business is the one which will achieve the objectives set by the managing coalition.

Measurements must be taken in order to know the likelihood of reaching the objectives set by management. To do so, one has to make use of a performance measurement system. Neely et al. [NGP95] define a performance measurement system as a set of metrics used to quantify both the efficiency and effectiveness of actions. Combining this definition with the previously described definition of performance, the next definition of a performance measurement system is formed:

A performance measurement system is a set of metrics used to quantify the efficiency and effectiveness of action, whereby a performing business is the one which will achieve the objectives set by the managing coalition.

Enterprise performance management uses the information gathered through this performance measurement system to effect positive change in organizational culture, systems and processes. [AB02] It enables an organization to effectively monitor, control, and manage the implementation of strategic initiatives. [FA06] Hereby it combines business strategy and technological structure to direct the entire organization towards accomplishing common organizational objectives. [AF08] Within this project, again a combination of definitions is used to define enterprise performance management:

Enterprise performance management is the use of quantified information about the efficiency and effectiveness of action to effectively monitor, control, and manage the implementation of strategic initiatives, combining the business strategy and technological structure to direct the entire organization towards accomplishing common organizational objectives.

3.2 Enterprise performance management system models

This paragraph serves as theoretical background on how an Enterprise performance management system model looks like. First performance measurement system (PMS) models are described and compared. Next, a summary is given on the functions an EPM system must have. Only the functions of an EPM system are mentioned, whereas no holistic EPM model was found in literature.

3.2.1 Performance measurement system models

Within this section performance measurement system models are summarized and compared. These models are quite abstract, giving guidance to companies on a high level by supplying a way to visualize a performance measurement solution.

3.2.1.1 Balanced scorecard

Although the balanced scorecard (BSC) was introduced in 1992 by Kaplan and Norton [KN92] as a pure measurement tool, it soon evolved towards a strategic management system. As a strategic management system, the BSC enables a company to link long-term strategy to short term actions. [KN96]

As Mooraj at al. [MOH99] state, the Balanced Scorecard is a tool which adds value by providing both relevant and balanced information in a concise way for managers, creating an environment which is conducive to learning organizations and eliminating the need for managers to 'choose' which type of control system to use at any given time. It contains outcome measures and the performance drivers of outcomes, linked together in cause-and-effect relationships and thus aims to be a feed-forward control system. [Nor00]
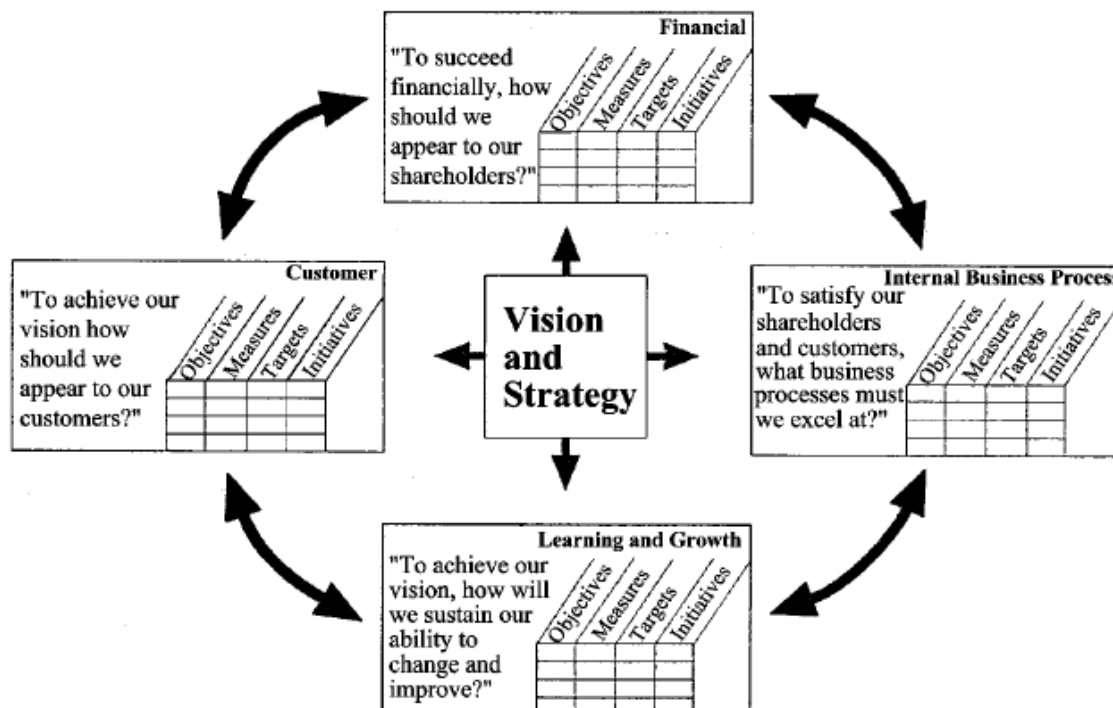
Figure 3 - Balanced Scorecard [KN96]

The basis of the BSC lies around the use of four perspectives, namely the financial, customer, internal business process and learning and growth perspectives, to determine the business performance. Within this method, the company translates its vision and strategy towards concrete goals with appropriate indicators, showing the degree of achieving these goals. Figure 3 represents the balanced scorecard.

After its creation, several applications of the BSC were introduced. Examples are the balanced IS scorecard by Martinsons[Mar99] to measure and evaluate IS activities, the IT balanced scorecard by Van Grembergen and Saull[VS01] to measure the performance of an IT project or IT department, and the Web Services Balanced Scorecard Framework by Huang and Hu [HH04] to match potential benefits of web services with corporate strategy.

3.2.1.2   Performance Pyramid System

The Performance Pyramid System (PPS) was originally developed by Judson in 1990[Jud90], and later improved by Lynch and Cross [LC91]. The purpose of the PPS is to link an organization's strategy with its operations by translating objectives from the top down (based on customer priorities) and measures from the bottom up. [Lai02]

The framework (Figure 4) ties together the hierarchical view of business performance measurement with the business process view. It also makes explicit the difference between measures that are of interest to external parties (customer satisfaction, quality and delivery) and measures that are primarily of interest within the business (productivity, cycle time and waste). [NMPR00]
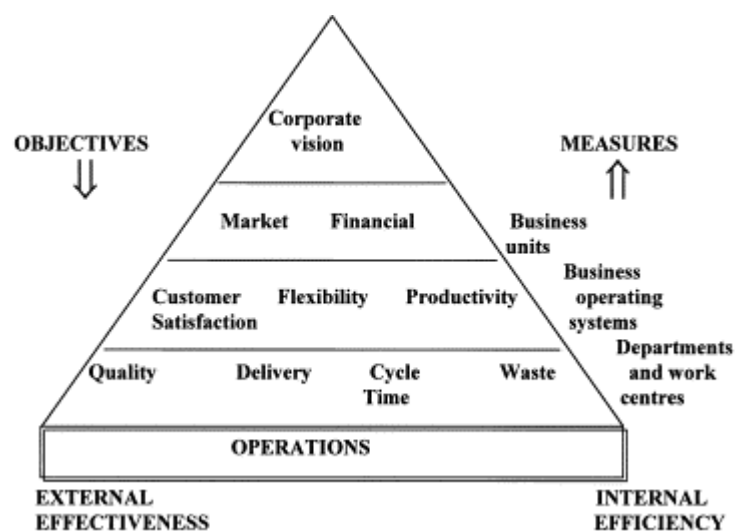
Figure 4 - Performance Pyramid System[LC91]

3.2.1.3   EFQM Business Excellence Framework

The introduction of the Business Excellence Model came after the European Foundation for Quality Management (EFQM) was founded in 1988, set up by 14 major European companies due to a lack of quality, productivity and competiveness in a dynamic world market. [WSG03] It was used as the assessment model for the European Quality Award since 1991, and later transformed into the Business Excellence Model as shown in Figure 5. [POG98] It consists of criteria a company can manipulate, the enablers, and criteria a company will achieve, the results.
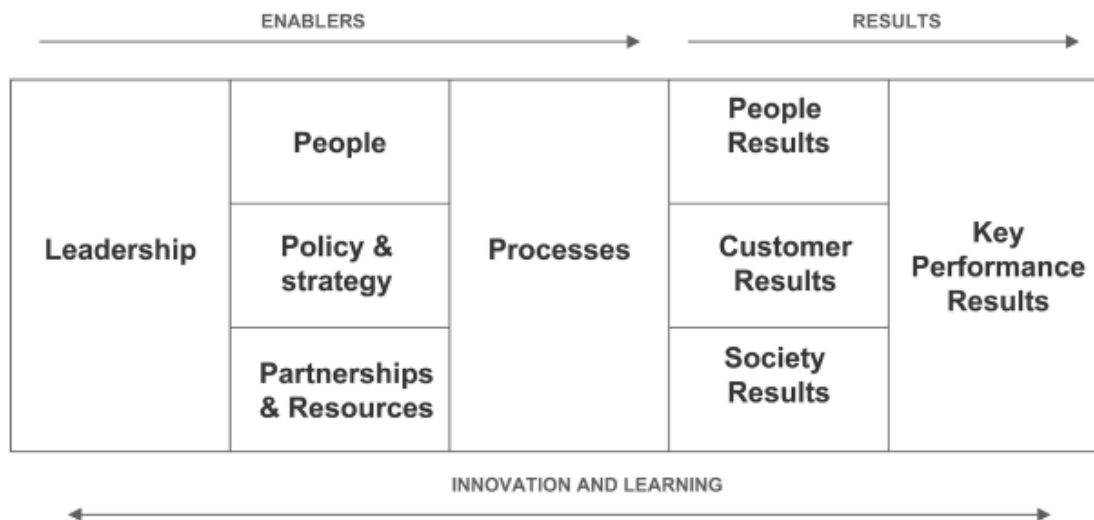
Figure 5 - EFQM Business Excellence Model [POG98]

3.2.1.4 Integrated Performance Measurement System

Laitinen [Lai02] created the Integrated performance measurement system (IPMS), specially designed for use within SMEs (see Figure 6). It is meant to be a useful managerial tool for measuring and improving performance in business firms.

The system is based on seven main dimensions of measures, classified as two external dimensions (financial performance and competitiveness) and five internal dimensions (costs, production factors, activities, products and revenues) linked by a causal chain. The internal dimensions are used to monitor the whole production process, and the external dimensions are used to monitor the position of the company in its competitive context. [GBB05]
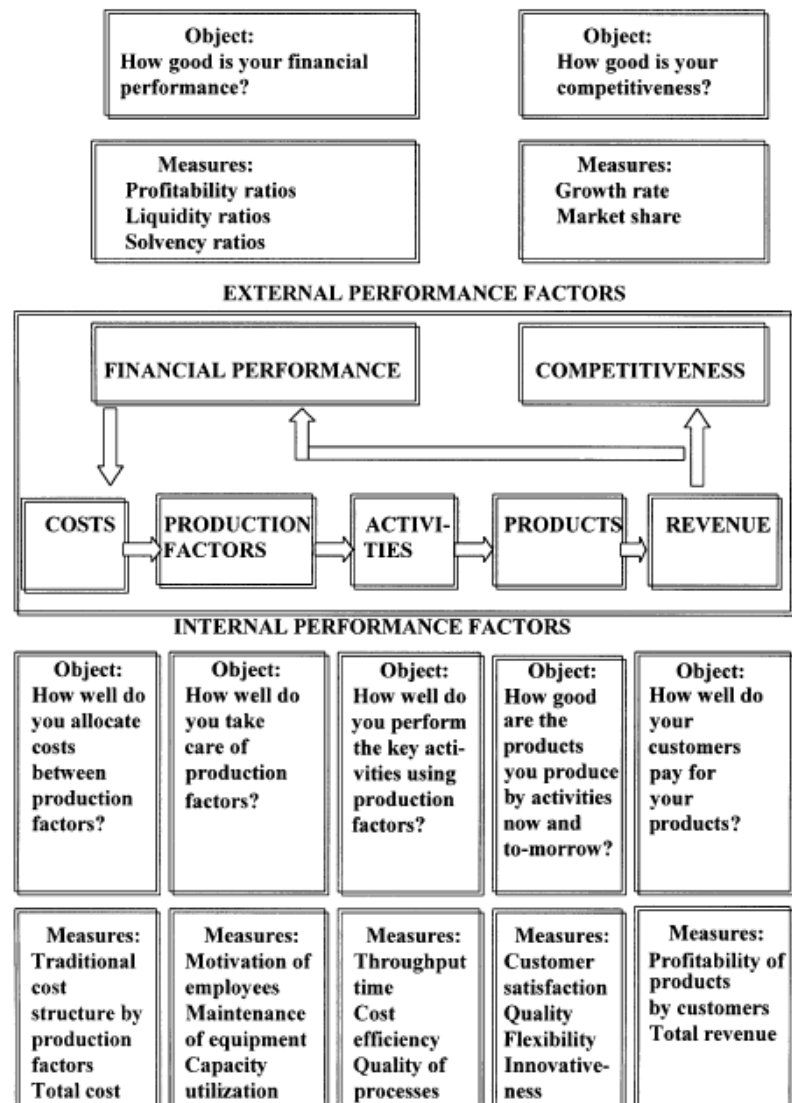
Figure 6 - IPMS by Laitinen [Lai02]

3.2.1.5   Integrated dynamic performance measurement model

Bitici and Turner [BTB00] state that a performance measurement system should be a dynamic system in order to keep the integrity, agility and responsiveness of the organization. In this way one can cope with changes in the internal as well as the external environment. Their view, as depicted by Figure 7, involves the principle of continuous improvement. The PDSA cycle, also known as the PDCA cycle, [Dem86] is incorporated to ensure that gains achieved through improvement programs are maintained.

The dynamic performance measurement system consists of an external and internal monitoring system to continuous monitor developments and changes, a review system to decide internal objectives and priorities, and an internal deployment system to deploy the revised objectives and priorities to critical parts of the system.

Whereas the need for change does not always come from top-management, Bitici and Turner [BTB00] state that Figure 7 applies to the whole business as well as to each business unit or business process within the business. Therefore the model is applied at different layers in the company, resulting in an integrated model as visualized in Figure 7. The elements of this integrated model are linked to each other, deploying objectives and priorities from higher levels down to lower levels.
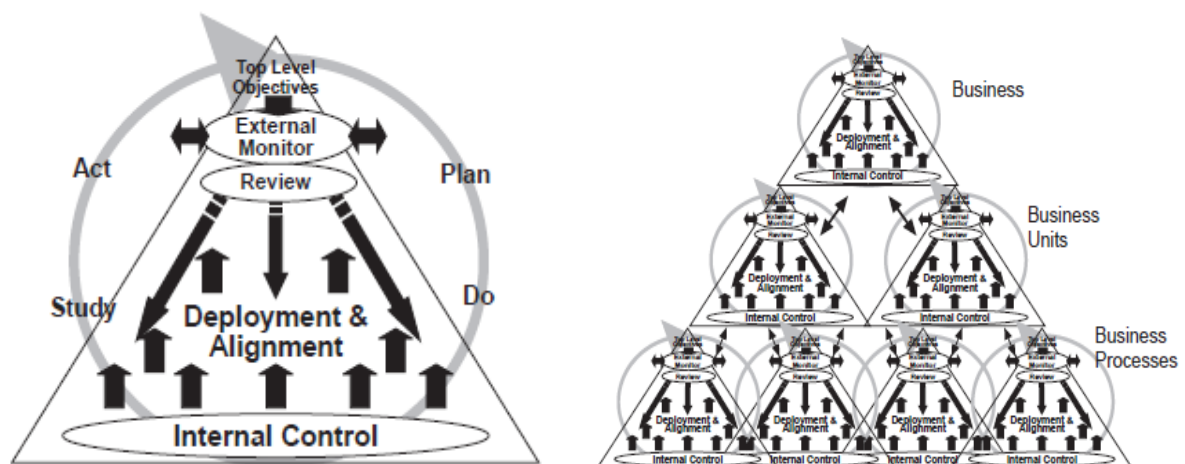
Figure 7 - Dynamic PMS model and the Integrated dynamic PMSs model [BTB00]

3.2.1.6 Performance measurement grid

Medori and Steeple [MS00] designed a framework for auditing and enhancing performance measurement systems (PMSs) as dealt with in paragraph 3.4.2.5. This framework includes the use of a performance measurement grid to select the best measures as shown in Table 1.

Table 1 - Medori and Steeple performance measurement grid [MS00]

Competitive priority	Company success factors	Parent company
Quality	Achieve customer quality Improve incoming quality Reduce cost of quality Customer satisfaction	
Cost	Improve efficiency in manufacturing Maintain inventory at ten days	Profit and loss Balance sheet cash flow
Flexibility	Increase employee skills	
Time	Improve manufacturing lead-time	
Delivery	Meet customer requirements	
Future growth	Improve new product introductions	

Folan and Browne [FB05] extended this grid, as can be seen in Figure 8. They linked performance measurements to three perspectives: the internal, supplier and customer perspectives. This resulted in adapted measurement categories linked to critical success factors.
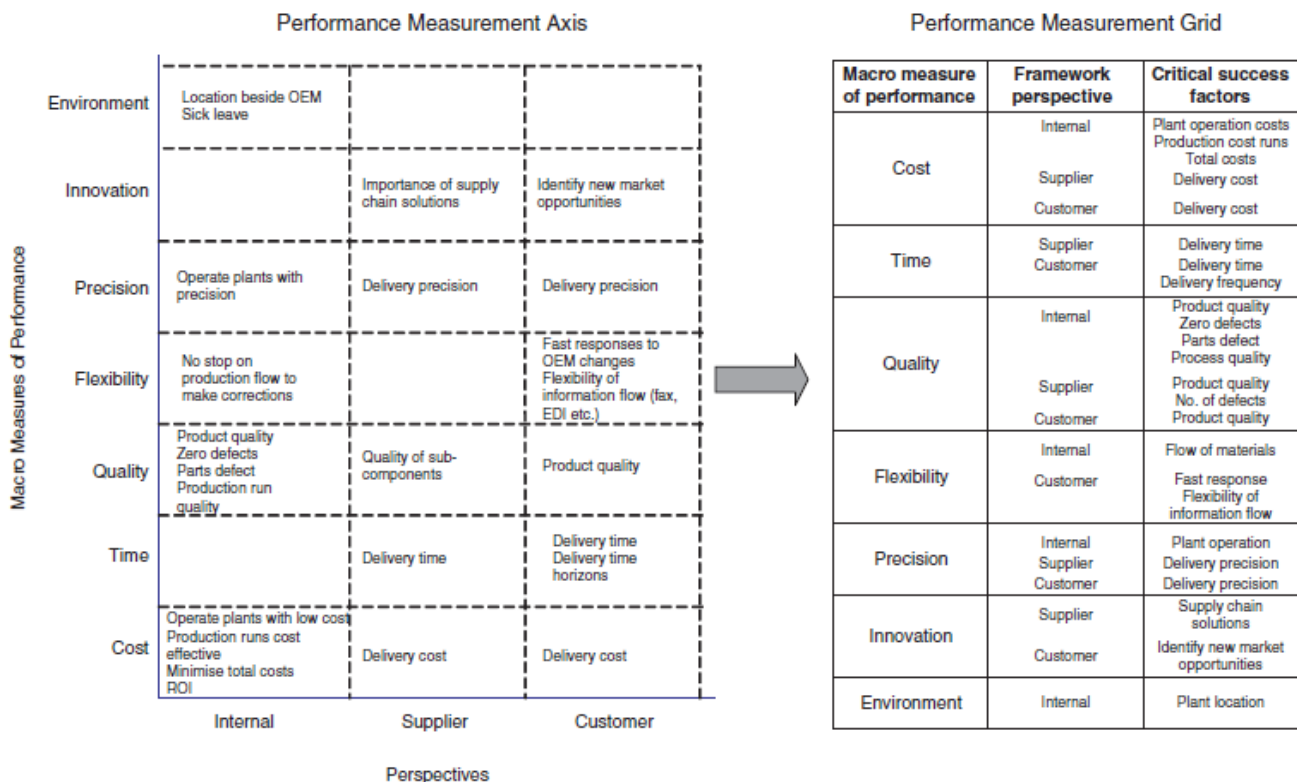
Figure 8 - Folan and Browne performance measurement axis and grid [FB05]

3.2.1.7   Comparison of performance measurement system models

This section provides an overview of performance measurement system models in literature. These models are quite abstract, giving guidance to companies on a high level by supplying a way to visualize a performance measurement solution. A comparison of these models has been made by developing a concept-matrix as depicted by Table 2. Within this matrix concepts from each of the PMS models are extracted and categorized. Similar concepts are combined, as indicated by the checkmark (✓). The table is divided in three parts, which are explained below.

Perspectives

The comparison starts with a summary of the perspectives incorporated within the different models. Herein it is proposed that one should look at an enterprise not only from a financial point of view, but also non-financial using different perspectives. This incorporates an internal as well as an external view, thus focusing on how the company operates internally as well as on how its environment responds to these operations.

Measurement categories

As a consequence of viewing the company from different perspectives, measurements must also be set from different points of view. The resulting categories as mentioned within the PMS models can therefore be placed within the defined perspectives. Within this comparison the measurement categories have been positioned under the perspectives of the balanced scorecard. Two measurement categories appear to be outside these perspectives, namely the competiveness and environment categories. Competiveness should help to determine how well the company is doing in the market, thus the level of how good it can compete with its competitors. The environment entails the working atmosphere within the company, thus having effect on the employees` satisfaction and indirectly on the productivity within the company.

General comparison

The last part of the comparison table consists of five statements derived from these models. The models imply that measures should be made at different business layers, giving managers at different business layers different measures to steer at. A company`s strategy must be expressed in objectives (also referred to as requirements or criteria) and measures, thereby setting targets (result criteria) to determine the company`s performance. The measures and objectives must constantly be revised, thereby incorporating continuous improvement. Operations must be linked to objectives, thereby elaborating on cause and effect relations.

Table 2 - Comparison of PMS models

	BSC [a]	PPS [b]	EFQM [c]	IPMS [d]	DPMS [e]	PMG [f]
Perspectives						
enablers			✓			
results			✓			
financial	✓					
customer	✓					✓
supplier						✓
external effectiveness		✓		✓	✓	
internal efficiency		✓		✓	✓	✓
internal business processes	✓					
learning & growth(innovation[c])	✓		✓			
Measurement categories						
Financial(business results[c])	✓		✓	✓		
revenue				✓		
costs				✓		✓
waste		✓				
Customer (satisfaction[d])	✓	✓	✓			
impact on society			✓			
quality (products[d])		✓		✓		✓
delivery(precision)		✓				✓
Business processes (activities[d])	✓		✓	✓		
(cycle[b]) time		✓				✓
flexibility		✓				✓
productivity		✓		✓		
resources				✓		
Learning & growth(innovation[f])	✓					✓
people			✓			
leadership			✓			
policy & strategy			✓			
Competiveness				✓		
Environment						✓
Measures at different business layers	-	✓	-	-	✓	-
Measures derived from strategy	✓	✓	✓	✓	✓	✓
Incorporate continuous improvement	✓	-	✓	✓	✓	✓
Link operations to objectives	-	✓	✓	✓	✓	✓
Cause & effect relations	✓	✓	✓	✓	-	-

[a] Balanced scorecard, [b] Performance Pyramid System, [c] EFQM Business Excellence Framework, [d] Integrated Performance Measurement System, [e] Integrated dynamic performance measurement model, [f] Performance measurement grid

3.2.2 EPM functions

Whereas literature does not provide a comprehensive model or list of functions of Enterprise performance management (and Performance measurement systems), a proposition of functions is made within this paragraph. Table 3 summarizes these properties which are based upon the frameworks and models of the previous paragraph, extended with suggestions from literature.

Table 3 - EPM functions

Function	Described as	Authors
Forecasting & planning	Anticipating the likelihood of achieving the targets	[Leb95]
	Take preventive actions	[Ecc91]
	Improve strategic planning	[FA06]
	Improve forecasting	[FA06]
	Drive forecasts	[Dre08]
	Predict results	[Dre08]
	Business planning	[KN96]
Feedback & learning	Allowing updating the performance measurement system itself to improve the chance to achieve the targets	[Leb95]
	Contributing to the continuous redefinition of the target(s) or objective(s)	[Leb95]
	Feedback and learning	[KN96]
Improve business processes	Eliminate all non-value-adding processes as soon as feasible	[Leb95]
	Deal with ineffective business processes	[FA06]
	Improve quality	[Ecc91]
	Better information drives learning and growth and enables more efficient business processes	[WSJS99]
	Dynamic adaptability	[GBB05]
Enable change	To change	[AB02]
	Change is demanded	[KN02]
	Scale and leverage data, users, and applications to allow for faster future growth	[Dre08]
	Influence behavior	[NGP95]
	Focus on Stakeholders	[GBB05]
Operationalize and develop the strategy	To translate the organizational vision into clear measurable outcomes that defines success, and which are shared throughout the organization and with costumers and stakeholders	[AB02]
	Link strategy to organizational processes	[FA06]
	Translating the vision	[KN96]
	Translate the strategy to operational terms	[ABV03]
	Measures must be designed in a way that it encourages behavior which will support the strategy	[BMWN00]
	Strategy development	[GBB05]
Support decision making	To choose between alternative strategies	[KM00]
	To prioritize activities	[KM00]

	Direct and focus the attention of decision makers on results and determinants	[KM00]
	Make aligned decisions across the enterprise based on insights derived from one version of the truth	[Dre08]
	Set targets	[ABV03]
	Budgeting	[Sha02]
Link rewards to performance	Linking incentives to performance	[Ecc91]
	Linking rewards to performance measures	[ABV03]
Deliver insights	Competitive benchmarking	[Ecc91]
	Understand the impact of changes across the enterprise	[Dre08]
	Piloting the business	[Leb95]
	Explore potentials	[Ecc91]
Report	To evaluate Information and Communication Technology projects	[MM04]
	Show the health of the company	[Sch04]
	Monitoring operations	[NMPR00]
	Reporting	[Sha02]
	Report on outcomes internally & externally	[Dre08]
Support cooperation	Communicating and linking	[KN96]
	Improve cross-functional cooperation along the supply chain to offer shorter delivery times, more flexibility and faster introductions of new products	[LFW04]
	Better synchronization across functional and national boundaries	[LFW04]
	To streamline Operations across a chain of separate companies to offer better service to end customers against lower costs for the supply chain in its totality	[LFW04]
	An EPM system must facilitate collaboration and information sharing	[Dre08]
Increase visibility	Increase visibility	[Dre08]
	Alert the players enterprise wide to things happening, and what needs presents action	[LFW04]
	Create transparency and visibility across the enterprise	[Dre08]
	Deliver visibility of information	[Sha02]
Information management		
Improve data integrity	Improvement of data integrity	[Dre08]
Improve timeliness of information	Time lag between business and IT planning processes	[ZJ99]
Increase information accessibility	An EPM system must provide the right information at the right time in the right format to the people who need it	[Dre08]

3.3 Factors influencing the method

Within this paragraph the factors influencing the method to design and implement EPM are summarized. This is done in two parts: critical success factors and 'EPM view'. The last one is incorporated to gain knowledge about the way the companies' organization and management method influences the EPM method.

3.3.1 Critical success factors

When designing and implementing an EPM system, one has to deal with several factors in order to make the project successful. Ariyachandra and Frolick [AF08] developed a list of ten critical success factors one needs to cope with when undertaking an EPM project. Within this overview, an elaboration on the list of Ariyachandra and Frolick is given by incorporating views of other authors. These factors are:

➢ Champion
One should have a committed, energetic project champion who actively supports and promotes the BPM project often providing information, material resources, and political support.

➢ Management of Resistance
The willingness or urgency to change and the corporate culture plays a crucial role in EPM success. [LFW04] [KN02] [KM00] Establishing a culture that embraces the use of performance measurement to manage the business is crucial, whereas e.g. the culture of an organization can encourage everyone to lie [NGP95] and measurement is considered to be a non-value adding activity which has to be endured. [KN02]

➢ Management Support
As Schultz [Sch04] denotes, the total company, virtually all employees, must buy in to the EPM concept for it to be effective. Top managers must understand the project and its potential hurdles, as they determine the allocation of personnel and financial resources. When difficulties arise, top management is then best placed to help the project team deal with them effectively. [Bie07] Therefore, strong sponsorship and support from upper management is needed. [FA06]

➢ Sufficient Resources
Resources required for an EPM effort include monetary resources, people, and time.

➢ Team Skills
Ariyachandra and Frolick made a distinction between process and technical skills needed for EPM project success. Hereby process skills are those skills needed to analyze business processes, and technical skills those needed to translate the metrics into a working application. Kennerley and Neely [KN02] mention skills to identify appropriate measures, to design measures/quantify performance, to collect accurate data and to analyze data as being the largest barriers to evolution.

➢ User Support
User participation and support ensures that user requirements are accurately captured and communicated to the development team.

➢ Effective Communication
The facilitation of communication between business and IT functions leads to a mutual understanding of the organization's strategic direction and goals.

➢ Clear Link to Business Strategy
Because EPM systems combine business strategy and technological structure, a clear link between the measures and the business strategy is needed [AF08], i.e. the measures must be designed in a way that it encourages behavior which will support the strategy. [BMWN00]

➢ State of Existing Data Management Infrastructure
To be able to deploy an EPM solution, organizations need an integrated data repository or BI infrastructure that can be used as a trusted source which delivers the single version of the truth. [Dre08] [Sch04] Being the only information source of the company, other sources must be included in the EPM system. [FA06] Therefore the state of the existing data management infrastructure plays a crucial role in the feasibility of an EPM project.

➢ Evolutionary Development Methodology
Ariyachandra and Frolick state that an evolutionary development methodology is widely acknowledged as a key factor for system success. This includes that senior management review and update the system and measures, and the used framework is clear and balanced. [FB03]

Other factors are those one has less influence on. These include environmental uncertainties, speed/pace of the business, government regulations and growth/change in business. [FA06]

3.3.2 EPM view

As a result of the interviews, it became clear that the structure of a company is of influence on the way EPM is applied. Therefore the organizational structure is included within the literature review. One must analyze the current organizational structure and decide which way to go. For example a company having a vertical functional structure can choose to transform its structure to a network structure by decentralizing decisions and reducing the chain of command. The structure will change from vertical to horizontal, improving horizontal communication. This is a constraint to define a learning organization [Daf03], improving transparency within the organization and thereby supporting the implementation of a complete EPM system. Because EPM must support decision making (see EPM functions, paragraph 3.2.2), also decision making models are treated within this section.

3.3.2.1 Organizational structure

The organizational structure of a company shows the chain of command within an organization. Whereas the organization`s management is important when setting up a performance management system, one must deal with the organizational structure when setting up an EPM system. According to Daft [Daf03] an organization can be structured in five ways, namely by using a vertical functional,

divisional, matrix, team-based or network approach. These approaches are visualized in Appendix D: Approaches to structural design.

Within a functional structure the grouping of positions into departments is based on similar skills, expertise and resource use. A divisional structure has departments grouped based on similar organizational outputs. The matrix approach utilizes functional and divisional chains of command simultaneously in the same part of the organization. With the team-based structure the entire organization is made up of teams that coordinate their work and work directly with customers to accomplish the organization`s goals. This structure is also referred to as horizontal grouping [Daf04] whereby employees are organized around core work processes, the end-to-end work, information, and material flows that provide value directly to customers. The network structure disaggregates major functions to separate companies that are brokered by a small headquarters organization.

Because `structure follows strategy' [Daf04], the company`s strategy determines how an EPM design should look like. Whereas the organizational structure to-be is determined within the EPM strategy, the EPM strategy must follow the business strategy. Other factors influencing structure are (EPM) technology and interdependence. Interdependence is the extent to which departments depend on each other for resources or materials to accomplish their tasks.

3.3.2.2 Decision making models

According to Daft [Daf03] three different decision making models exist, namely the classical, administrative and the political model. Each of these models is used in different situations, as summarized in Table 4. Because within an EPM system objectives and targets are defined, different alternatives are analyzed and rational choices are made, it is proposed that EPM best supports the classical decision model. When the company has an administrative or political model, it should try to convert this to the classical model. Otherwise, the EPM system should be designed or used differently.

Table 4 - Decision making models [Daf03]

Classical model	Administrative model	Political model
clear-cut problem and goals	vague problem and goals	pluralistic; conflicting goals
condition of certainty	condition of uncertainty	condition of uncertainty/ambiguity
full information about alternatives and their outcomes	limited information about alternatives and their outcomes	inconsistent viewpoints; ambiguous information
rational choice by individual for maximizing outcomes	satisficing[2] choice for resolving problem using intuition	bargaining and discussion among coalition members

---

[2] Decision makers choose the first solution alternative that satisfies the minimal decision criteria, regardless of the presumed existence of better solutions. [Daf03]

3.4 EPM method: system design and implementation frameworks

This section deals with the frameworks to design and implement performance measurement systems (PMSs) and enterprise performance management (EPM) systems from literature. Hereby it must be noted that designing and implementing an EPM system is done in parallel with the design and implementation of a PMS, whereas these are intertwined with each other. Because of this, the phases and steps/activities from the PMS framework should also be included within the phases and steps/activities from the EPM framework.

At the end of this section the frameworks are compared to recover phases and steps/activities needed when designing and implementing an EPM solution. The outcomes will be used in the solution design (chapter 5), and to structure the recovered phases and steps within the analysis of current practices (chapter 4).

3.4.1 Enterprise performance management system frameworks

3.4.1.1 Otley`s main set of questions

Otley [Otl99] state that when developing a framework for managing organizational performance, five main sets of questions must be addressed. These questions are constant, but organizations need to constantly develop new answers to them. Table 5 shows these questions and its corresponsive issues.

Table 5 - Main set of questions[Otl99]

Issues to be addressed when developing a framework for managing organizational performance	
Objectives	What are the key objectives that are central to the organization's overall future success, and how does it go about evaluating its achievement for each of these objectives?
Strategies and plans	What strategies and plans has the organization adopted and what are the processes and activities that it has decided will be required for it to successfully implement these? How does it assess and measure the performance of these activities?
Targets	What level of performance does the organization need to achieve in each of the areas defined in the above two questions) and how does it go about setting appropriate performance targets for them?
Rewards	What rewards will managers (and other employees) gain by achieving these performance targets (or, conversely, what penalties will they suffer by failing to achieve them)?
Feedback	What are the information flows (feedback and feed-forward loops) that are necessary to enable the organization to learn from its experience) and to adapt its current behavior in the light of that experience?

3.4.1.2   BPM framework by Frolick and Ariyachandra

Frolick and Ariyachandra [FA06] developed the Business Performance Management framework in 2006, which is a framework for understanding the set of ideas, conditions, and assumptions that determine how to approach EPM. It consists of four core processes which, in their view, are the foundation for designing, implementing and managing BPM. The steps form a closed loop that captures business strategy, which is then translated into strategically aligned business operations. The framework can be recovered from Figure 9. A short explanation of the processes is given below.

Strategize
Within the strategizing process the organization establishes what it wants to achieve. Herein objectives are set and key performance indicators are determined.

Plan
The planning step is used to develop a program of action on how to carry out the strategy.

Monitor and analyze
This step facilitates constant monitoring of performance results versus benchmark metrics. It helps to evaluate individual and business unit performance.

Figure 9 - BPM framework[FA06]

Take corrective action
This step entails taking timely, appropriate action to changes in performance uncovered during monitoring and analysis. It provides users with guidelines and suggestions on how to deal with problems that arise.

3.4.1.3   Business Performance Management Lifecycle by Zeng et al.

Zeng et al. [ZLDC06] came up with the Business performance management (BPM) lifecycle, consisting of five steps as displayed in Figure 10. It is a policy-driven approach to implement dynamic EPM solution evolutions, thereby applying continuous improvement to be able to react on changes. One should notice that their cycle must be read counterclockwise. An explanation of the steps is given below.

Model
The first step is to model the BPM solution as an abstraction of an observation system, which captures the requirements of BPM solutions.

Deploy
In the deployment phase, after performing a series of transformations on an observation model, the executable code is generated and then deployed into the runtime platform.
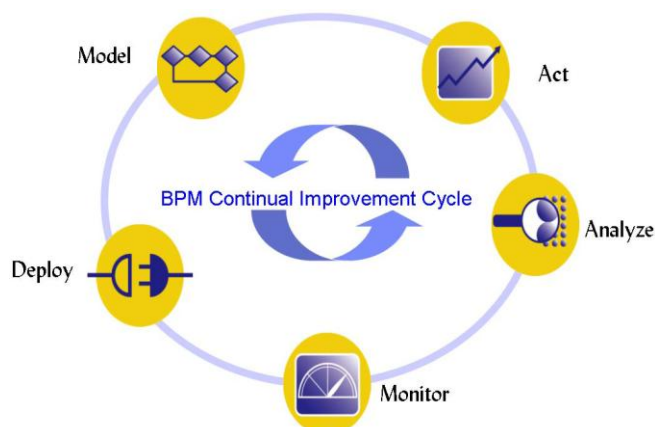
Figure 10 - Business Performance Management Lifecycle[ZLDC06]

Monitor
Once the BPM runtime component is deployed, it monitors business activities by measuring metrics and detecting business situations.

Analyze
The monitoring results are used to perform further analysis, e.g. what-if or root-cause analysis.

Act
The final phase is taking actions for improving the business performance. These actions may include for example re-engineering business processes.

3.4.1.4   Six stage system by Kaplan and Norton

Kaplan and Norton [KN08] claim that they have formulated the architecture for a comprehensive and integrated management system that explicitly links strategy formulation and planning with operational execution. The closed-loop helps companies to validate and challenge their strategic hypothesis and, if necessary, modify and change it in a timely, proactive way. It consists of six steps, as illustrated in Figure 11. These are:

Stage 1: Develop the strategy
The system begins when executives develop their strategy. In this stage, companies address three questions:

- What business are we in, and why?
- What are the key issues we face?
- How can we best compete?

Stage 2: Plan the strategy
Managers plan the strategy by developing strategic objectives, measures, targets, initiatives, and budgets that guide action and resource allocation. In order to do so, five questions are to be addressed:

- How do we describe our strategy?
- How do we measure our plan?
- What action programs does our strategy need?
- How do we fund our initiatives?
- Who will lead strategy execution?

Stage 3: Align the organization
According to Kaplan and Norton, executives must link company strategy to the strategies of their business and functional units, and must align and motivate employees. Three questions are addressed:

- How do we ensure that all business units are aligned?
- How do we align support units with business-unit and corporate strategies?
- Ho do we motivate employees to help us execute the strategy?

Stage 4: Plan operations
The operational plan links long-term strategy with day-to-day operations. Two key questions are to be addressed:

- Which business process improvements are most critical for executing the strategy?
- How do we link strategy with operating plans and budgets?

Stage 5: Monitor and learn
Companies should hold separate operational and strategy review meetings in order to avoid having short-term operational and tactical issues displace discussion of strategy implementation and adaptation. Different questions are addressed within these two meetings:

- Are our operations under control?
- Are we executing our strategy well?

Stage 6: Test and adapt the strategy
The strategy testing and adapting meeting, addresses the fundamental question:

- Do we have the right strategy?

Note that testing and adapting the existing strategy should be part of the strategic analysis done in the first management system stage.
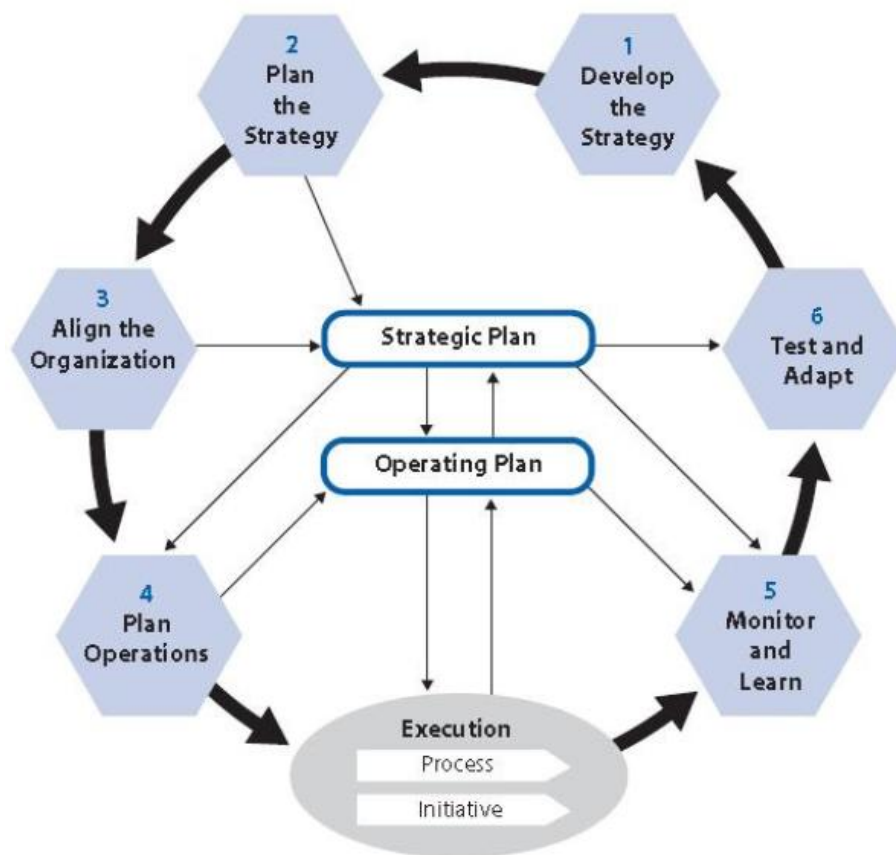
Figure 11 - A closed-loop management system linking strategy and operations[KN08]

3.4.1.5 BPM solution guidelines by Chowdhary et al.

Chowdhary et al. [CBCC06] developed a set of guidelines for the design and development of a complex EPM solution. They've noted that although it is expressed as six steps, it might take several iterations of design and development before an optimal level of solution maturity is achieved and business monitoring requirements are met. The guidelines are visualized in Figure 12.

BPM requirements and goals	Step 1	Requirement gathering (business process, data, goals, reports)
	Step 2	Analyze and transform requirements (event data, metrics, KPIs, context, rules, views)
BPM Platform-Independent Model	Step 3	Map the requirement to models and their constructs (e.g., OMs and monitoring contexts)
	Step 4	Provide additional model-related information (metric calculation, outbound event, data warehouse needs)
	Step 5	Model transformation into intermediate models (data warehouse model, runtime model, view model)
BPM Platform-Specific Model	Step 6	Platform-Specific Models and deployment (OM-runtime code, data warehouse schema, ETL, event emitters)

Figure 12 - BPM solution guidelines [CBCC06]

3.4.1.6   A model EPM methodology by Dresner

According to Dresner [Dre08], a successful EPM methodology is highly structured and includes four components, as illustrated in Figure 13.

Project management

The first component entails the management of the standards across the various EPM projects and project phases.

Envision the EPM Solution

Within the second component, the creation and management of the overall EPM vision and strategy takes place. Envisioning the EPM solution is an ongoing set of activities requiring executive support. The process becomes a cycle within itself as the EPM vision is developed and refined, and input from stakeholders is incorporated into the solution.

The first step is to define the EPM solution within your organization. Herein top management and key stakeholders create and document business drivers. Once the overall EPM vision has been created, it can be broken down into business processes, sub-processes, and lower level requirements. During this step a scope and charter will be formed, outlining the breakdown of the EPM vision into manageable phases and the requirements that need to be addressed in each phase. This scope and charter become the initial roadmap.

The scope and charter will also form the foundation for the EPM prototype. This prototype provides top management with a "storyboard" on how they can measure and manage the business using the provided toolset and business processes. The cycle repeats itself as feedback is collected and user acceptance is achieved. Once the implementation begins, the same cycle is used for previewing the solution in the field. This feedback loop needs to be used to make sure the performance being measured by the solution is driving the behaviors supporting the EPM vision.

Implementation

Within this component the EPM solution is delivered. Dresner notes that when implementing EPM, it is critical to follow a highly structured process. Several approaches can be used, including the classic Waterfall approach [Roy87] which was used within this methodology.

Education

According to Dresner, effective education is one of the best ways to ensure the successful implementation and utilization of an EPM solution.
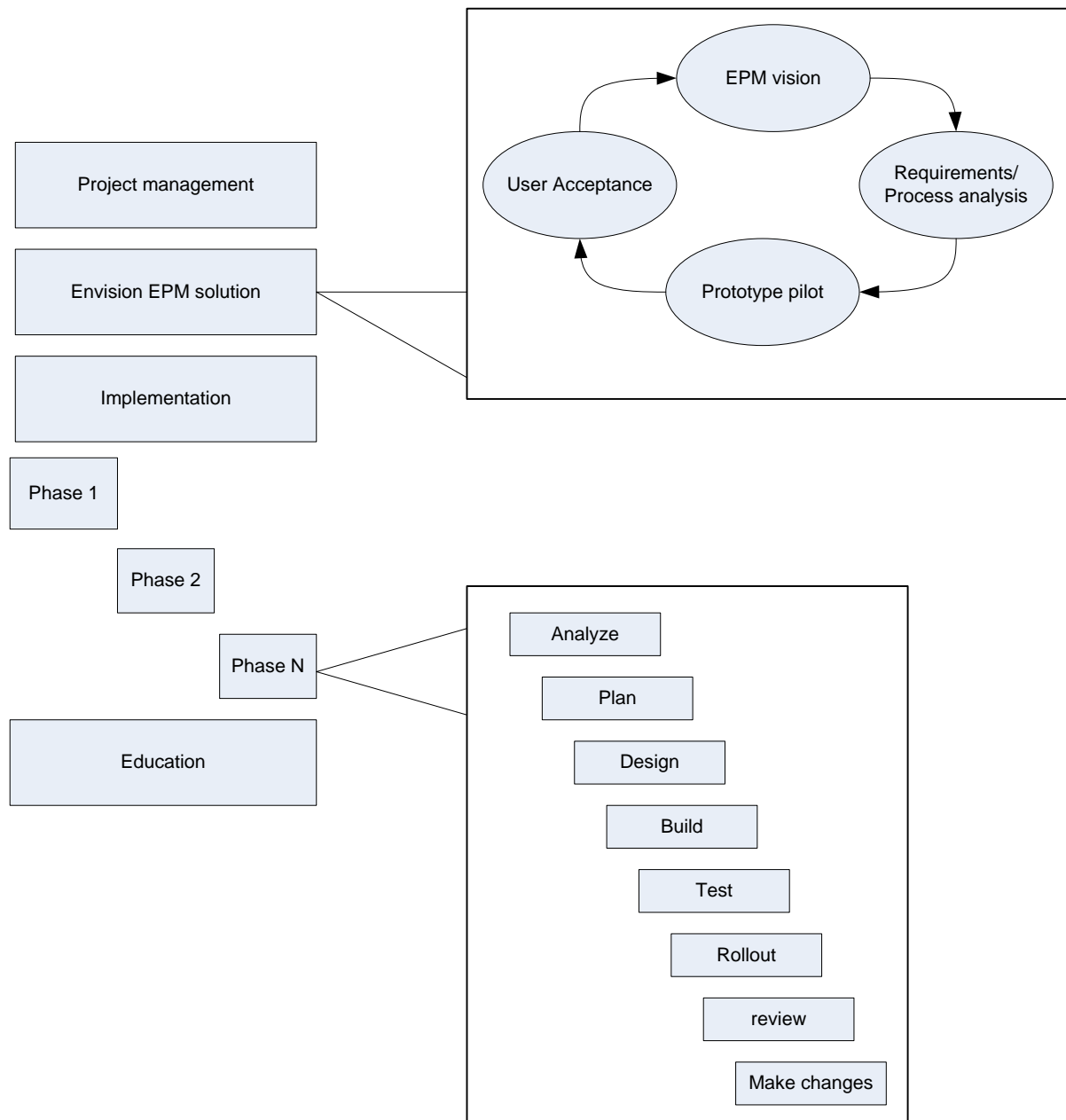
Figure 13 - EPM methodology by Dresner[Dre08]

3.4.2 Performance measurement system development frameworks

3.4.2.1 Phases in PMS development

Bourne et al. [BMWN00] made a framework on what they believe are the phases of performance measurement system development (Figure 14). It is proposed that the development of performance measurement systems can be divided into three main phases. These are:

- ➢ The design of the performance measures;
- ➢ The implementation of the performance measures;
- ➢ The use of the performance measures
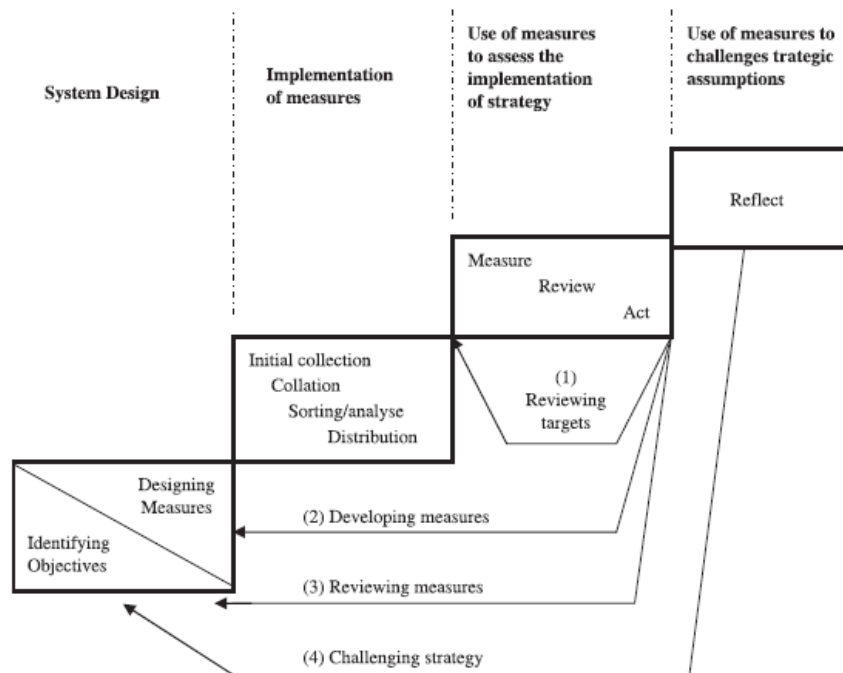
Figure 14 - Phases in PMS development[BMWN00]

3.4.2.2 Building a Balanced Scorecard

Kaplan and Norton [KN00] developed an eight-step process to build a Balanced Scorecard (BSC), as depicted by Figure 15. The steps of the process are briefly described below.

1. *Preparation*
   Identify the business unit for which a top-level BSC is appropriate.
2. *Interviews – first round*
   Identify the company`s strategic objectives and possible performance measures for the scorecard.
3. *Executive workshop – first round*
   Develop a draft BSC.
4. *Interviews – second round*
   Discuss outcomes of the workshop.
5. *Executive workshop – second round*
   Debate the mission and strategy statements and formulate stretch targets for each measure.
6. *Executive workshop –third round*

Reach final consensus on the vision, objectives and measurements, develop stretch targets for each measure on the scorecard and identify preliminary action programs to achieve the targets.

7. *Implementation*
   Formulate detailed implementation plan.

8. *Periodic reviews*
   Revise BSC metrics as part of the strategic planning, goal setting, and source allocation processes.

1.	Preparation
2.	Interviews – first round
3.	Executive workshop – first round
4.	Interviews – second round
5.	Executive workshop – second round
6.	Executive workshop – third round
7.	Implementation
8.	Periodic reviews
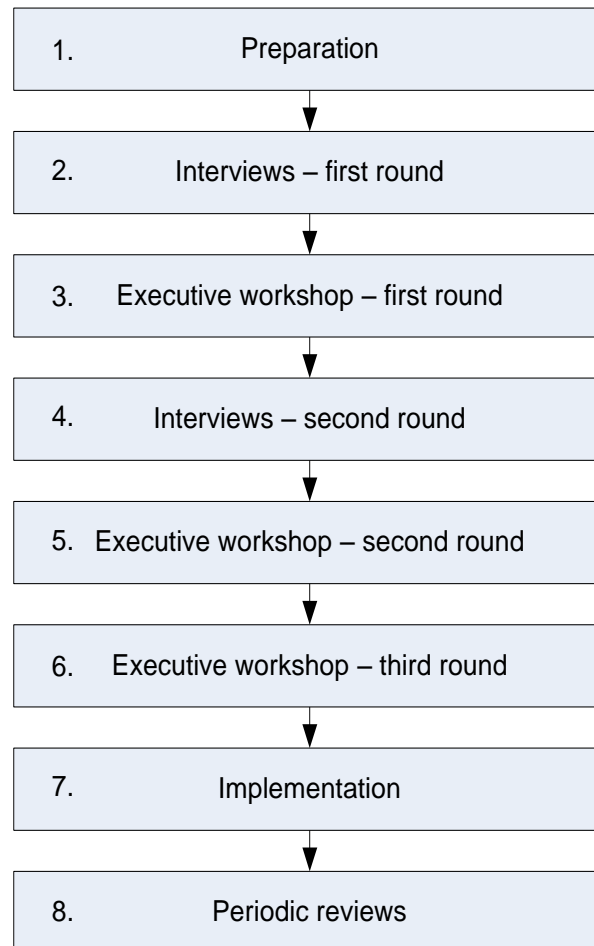
Figure 15 - Steps to build a BSC[KN00]

3.4.2.3   PMS design process by Wisner and Fawcett

As Figure 16 shows, Wisner and Fawcett [WF91] described the design of a performance measurement system (PMS) as a continuous process.
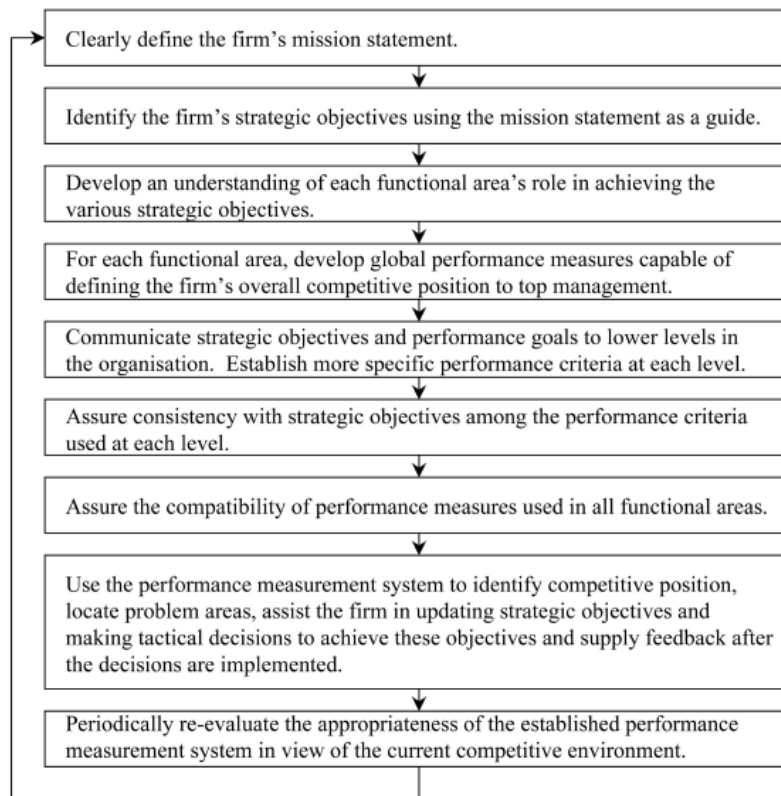
Figure 16 - Process for performance measurement system design[WF91]

3.4.2.4   PMS design process by Neely et al.

In their workbook, Neely et al. [NMPR00] reformulated the PMS design process towards a more prescriptive method for designing a performance measurement system. Figure 17 shows an abstract of their newly defined process.
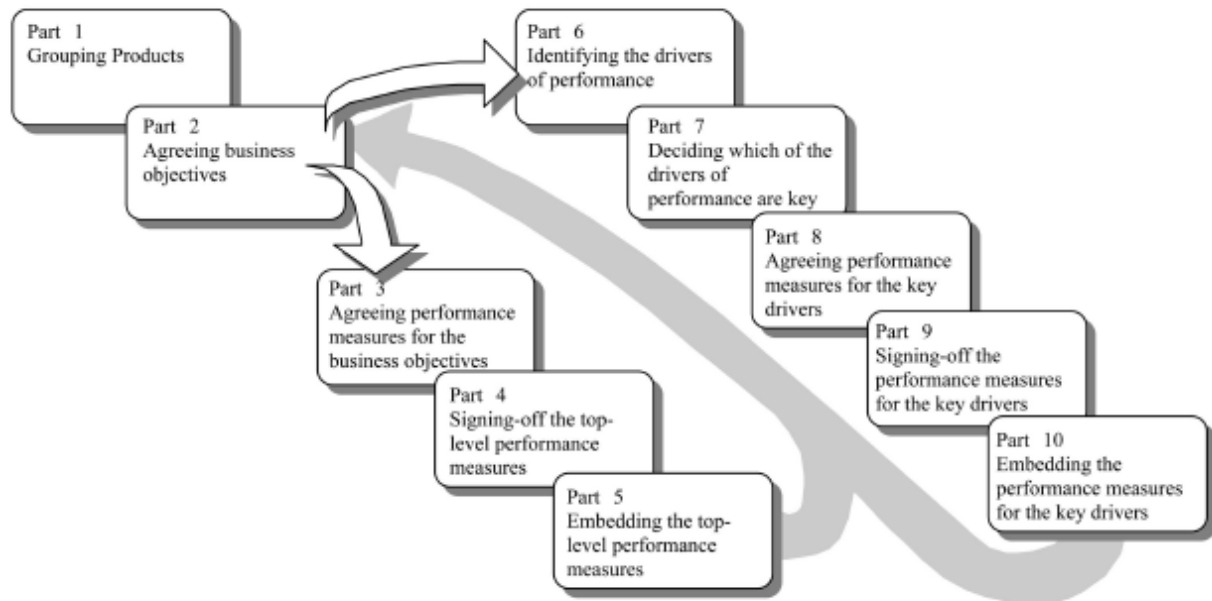
Figure 17 - PMS design process[NMPR00]

3.4.2.5 Medori and Steeple framework for auditing and enhancing PMSs

Medori and Steeple [MS00] designed a framework for auditing and enhancing performance measurement systems (PMSs). It was developed to be a useful method to allow companies to assess their existing performance measurement systems. According to Pun and White [PW05], the unsatisfactory aspect of this approach is the lack of a structured process for overall development.

The framework structure (Figure 18) revolves around a six-stage plan that incorporates the basic framework design requirements. These stages are:

Stage 1: Company success factors
The framework begins with defining a company's manufacturing strategy, which should include customer requirements. Next, the identified strategic requirements of Stage 1 are listed in the performance measurement grid (PMG) of stage 2.

Stage 2: Performance measurement grid
The PMG combines the six competitive priorities (i.e. quality, cost, flexibility, time, delivery and future growth) and matches them to the strategic requirements identified in stage 1.

Stage 3: Selection of measures using spectrum/checklist
This stage incorporates the use of PMG to identify the general areas which need to be measured, and interrogates a company's spectrum/checklist to select the most appropriate measures for the company.

Stage 4: Audit
In this stage the company's existing PM system is audited. The existing set of measures is listed down and compared with the new measures that have been identified and selected within Stage 3.

Stage 5: Implementation of measures
Measures identified in stage 4 as being critical (i.e. gaps) need implementing. This stage also applies to companies implementing an entirely new set of measures identified from Stage 3.

Stage 6: Periodic maintenance
This stage addresses the periodical reviewing of a company's PM system. This is particularly applicable to companies that change their strategy, implement new technology and so on.
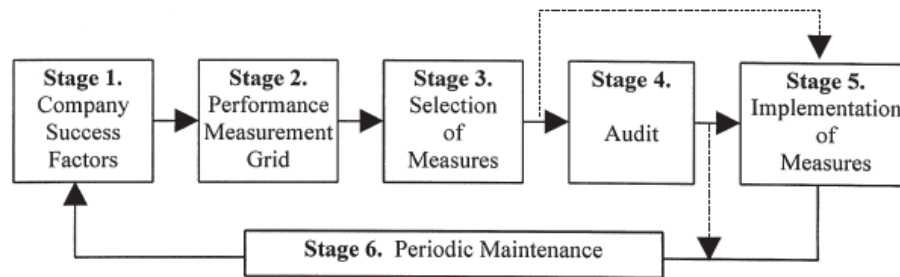
Figure 18 - Framework for auditing and enhancing PMSs[MS00]

3.4.2.6 *Methodological framework for Balanced Scorecard synthesis and implementation*

In 2005 Papalexandris et al. [PIPE05] developed an integrated methodological approach for BSC synthesis and implementation, as can be seen in Figure 19. The process was produced on the basis of six different phases, namely:

- ➢ Prepare for the project
- ➢ Understand the vision and the strategy
- ➢ Identify the strategic priorities and objectives
- ➢ Select performance measures
- ➢ Operationalize the project
- ➢ Implement and rollout the system

According to the authors, the corresponding activities within each phase are to be separated into core activities and supporting activities. The supporting activities are in the field of project & process management, information technology, quality assurance and risk management, and change management.
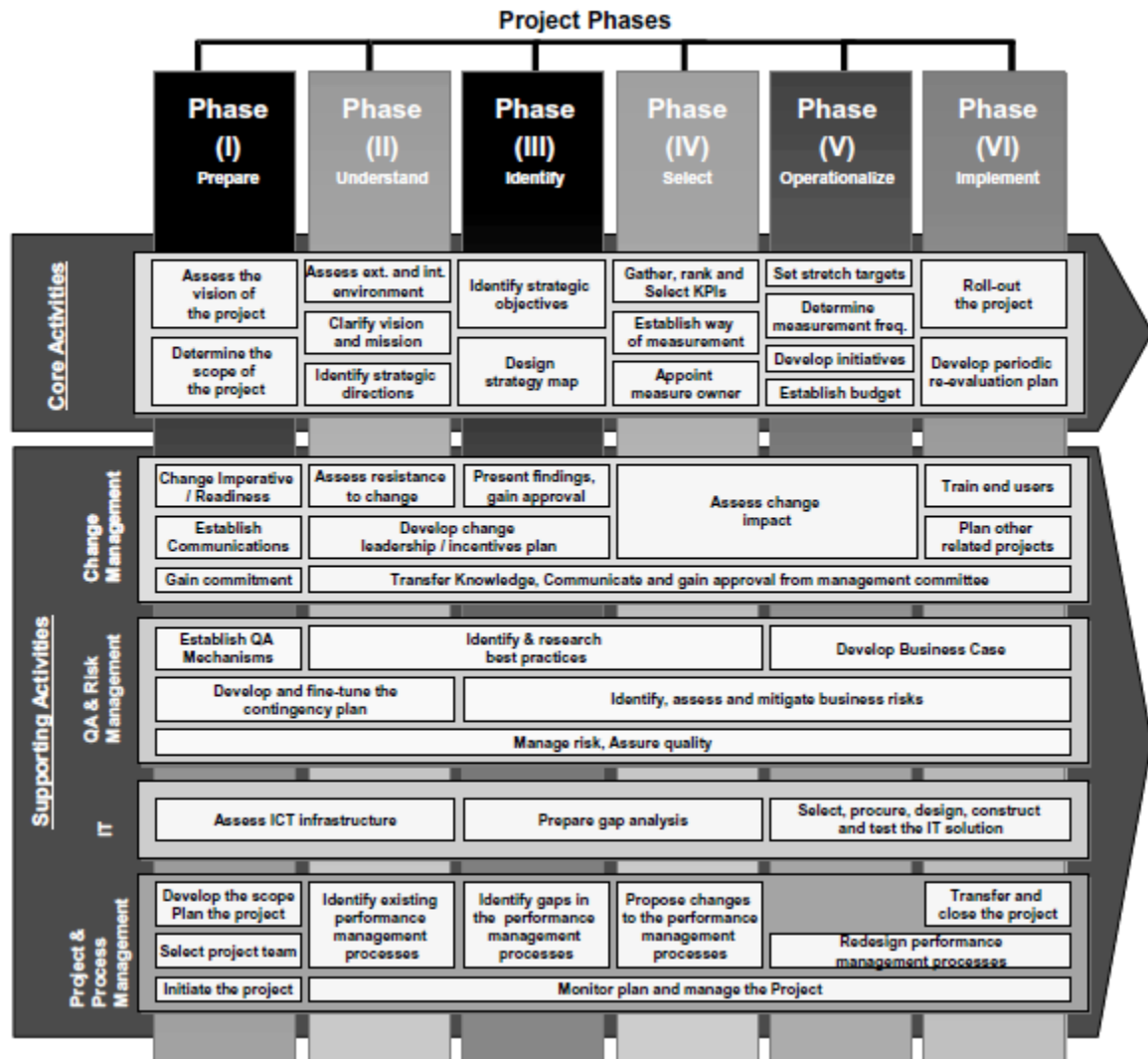
Figure 19 - Integrated methodological approach for BSC synthesis and implementation[PIPE05]

3.4.3   Comparison of frameworks

Within this paragraph a comparison is made between the different frameworks to design and implement a PMS or EPM system. When analyzing these frameworks, it appears that these differ a lot in style. The frameworks apply PMS in phases, step-by-step or through a combination of both. Several different activities are listed, using techniques like interviewing and workshops in order for the activities to be executed. This paragraph is therefore divided in three parts. First the phases in designing and implementing EPM and PMS are extracted from the frameworks. Next, the steps and activities when designing and implementing a PMS are summarized providing a comparison between these frameworks. This paragraph is closed with a comparison between the EPM system frameworks, indicating the current state of affairs in literature regarding EPM design and implementation.

3.4.3.1   *Phases in designing and implementing EPM and PMS*

Three of the EPM frameworks described in this section have a description of phases when designing and implementing an EPM solution. When analyzing these phases, it is clear that a direct resemblance exists with the Plan, Do, Check, Act (PDCA) cycle from Deming [Dem86]. Deming refers to this cycle as the Shewhart cycle, after statistician Walter Shewhart [Cle95]. The cycle is illustrated by Figure 20. Therefore within Table 6 the phases of these models are summarized, arranged by the phases of the PDCA cycle. Whereas EPM and PMS are intertwined, the table also includes a summary of phases within PMS design and implementation based on PMS frameworks including phases.
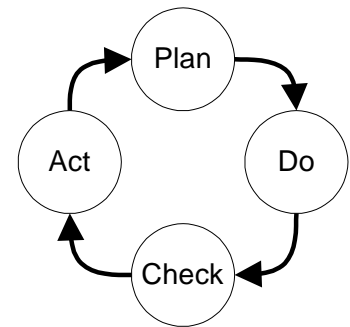
Figure 20 - PDCA cycle [Dem86]

Table 6 - Phases in designing and implementing EPM and PMS

	EPM			PMS		
[Dem86][a]	[FA06][b]	[ZLDC06][c]	[KN08][d]	[BMWN00][e]	[MS00][f]	[PIPE05][g]
plan	strategize	model	develop strategy	system design	company success factors	prepare
	plan		plan strategy		performance measure-ment grid	understand
		align			selection of measures	Identify
		plan operations		audit	select
						Operationa-lize
do		deploy	execute	Implementa-tion of measures	Implementa-tion of measures	implement
check	monitor & analyze	monitor	monitor & learn	assess strategy implementat ion	periodic maintenance	
		analyze				

| **act** | take corrective action | act | test & adapt | challenge strategic assumptions |

[a] PDCA cycle, [b] BPM framework by Frolick and Ariyachandra, [c] Business Performance Management Lifecycle by Zeng et al., [d] Six stage system by Kaplan and Norton, [e] Phases in PMS development, [f] Medori and Steeple framework for auditing and enhancing PMSs, [g] Methodological framework for Balanced Scorecard synthesis and implementation

3.4.3.2   Steps and activities when designing and implementing PMS

Within the design and implementation of performance measurement systems, several steps or activities must be executed. The summary of these steps or activities is used to compare the PMS frameworks from paragraph 3.4.2. Hereby it must be noted that the framework for auditing and enhancing PMSs from Medori and Steeple is excluded, whereas it merely consists of stages and thus lacks steps to execute these phases. However, this framework is already dealt with in Table 6 to identify the phases in EPM and PMS design and implementation.

Table 7 - Steps and activities when designing and implementing PMS

	[BMWN00][a]	[KN00][b]	[WF91][c]	[NMPR00][d]	[PIPE05][e]
project vision		✓			✓
determine scope/identify business unit		✓			✓
assess environment					✓
define mission		✓	✓		✓
identify directions/strategy		✓			✓
identify objectives	✓	✓	✓	✓	✓
design strategy map					✓
identify performance drivers				✓	
determine key drivers				✓	
design/collect measures	✓	✓	✓	✓	✓
group measures (f.e. via draft BSC or products)	✓	✓	✓	✓	
sort & analyze measures	✓	✓	✓		
top-level measures				✓	
prioritize/rank measures	✓				✓
determine way of measurement					✓
measure owners/roles			✓		✓
set targets		✓			✓
communicate measures to lower levels			✓		
formulate action plan to reach targets		✓			
formulate implementation plan		✓			
determine frequency					✓
develop initiatives					✓
establish budget					✓
roll-out		✓			✓
re-evaluate/review/revise		✓	✓	✓	✓

[a] Phases in PMS development, [b] Building a Balanced Scorecard, [c] PMS design process by Wisner and Fawcett, [d] PMS design process by Neely et al., [e] Methodological framework for Balanced Scorecard synthesis and implementation

3.4.3.3 Comparison of EPM frameworks

As Table 8 shows, the recovered EPM frameworks from literature differ a lot in style and contents. Four of them are procedural, thus providing steps or phases to come to a system. The other two are structural and provide some ideas on approaching an EPM project. The description of the frameworks in the table shows that the frameworks differ in implementation level and context.

Table 8 - Comparison of EPM frameworks

	structural	procedural	Description framework
[Otl99][a]	✓		list of issues
[FA06][b]		✓	"foundation" for EPM design & implementation
[ZLDC06][c]		✓	policy-driven EPM approach
[KN08][d]		✓	architecture to link strategy and operations
[CBCC06][e]		✓	model-driven guidelines
[Dre08][f]	✓		high level EPM development components

[a] Otley`s main set of questions, [b] BPM framework by Frolick and Ariyachandra, [c] Business Performance Management Lifecycle by Zeng et al., [d] Six stage system by Kaplan and Norton, [e] BPM solution guidelines by Chowdhary et al., [f] A model EPM methodology by Dresner

3.5 Conclusion of literature review

One of the goals of this chapter was to seek an answer to the question 'What is the current state of affairs in literature, regarding enterprise performance management?'. It answered this question by providing an overview of the current theoretical knowledge on performance measurement and enterprise performance management (EPM) models and frameworks. Hereby each of the parts of the conceptual framework of paragraph 2.3 was dealt with. There is evidence that this framework is sufficient, whereas it was possible to place each of the found models and frameworks within the framework.

As shown in this chapter, no holistic EPM model exists within the scientific literature. A list of EPM functions was extracted from literature and performance measurement system (PMS) models were described to research this matter. Therefore, one can state that current literature lacks a holistic EPM model.

Literature does provide several system design and implementation frameworks for EPM and PMS. The recovered EPM frameworks differ in implementation level and context, whereby no all-encompassing methodological approach for EPM design and implementation was found.

The models we did find, together with the PMS frameworks, were compared within this chapter to provide input for the method-to-be-designed. Herein an analysis was made of the phases, steps and activities of the system design and implementation frameworks. A direct resemblance with the Plan, Do, Check, Act cycle was found, which will be used to structure the phases of the method.

Literature provides several critical success factors (CSFs) for an EPM project, whereby the list of factors from Ariyachandra and Frolick [AF08] is the most complete one. CSFs found in other literature sources can all be arranged within the defined factors of this list. This supports the statement that this list is sufficient for EPM projects.

4 Current practices

While the previous chapter showed what current literature state about enterprise performance management (EPM) design and implementation, this chapter elaborates on this from a practical point of view. In succession, the combination of both the literature review and the analysis of current practices will lead to the solution design (chapter 5).

This chapter provides the combination of the research findings and the analysis of current practices. It analyzes the five expert interviews, and documents in the form of PowerPoint slides, whitepapers, leaflets and books. Information from software vendors is used to describe the EPM system models in practice. The entire method used to analyze current practices can be recovered from paragraphs 2.4, 2.5 and 2.6. The conceptual framework from paragraph 2.3 is used to structure the presentation of the combined findings and analysis.

The chapter starts with an elaboration of EPM system models in practice to understand how an EPM system could look like in practice (paragraph 4.1). It is part of the answer to the question '*What are the properties of an EPM solution in practice?*' by comparing EPM system models from interviews with those supplied by EPM software vendors.

The second paragraph (4.2) describes the factors influencing the method for EPM design and implementation. These factors will thus be used when developing the solution design. It is split in two parts: the critical success factors of EPM and 'EPM view'. 'EPM view' is incorporated to give information about the expert`s view on EPM. This includes statements about how the company should be steered and how EPM should support this managing method. It also involves statements about the way EPM should be scoped. The paragraph answers the question '*What are constraints one has to deal with when designing and implementing an EPM solution in practice?*'.

The third paragraph *(4.3)* entails a description of the EPM method from a practical point of view. It provides answers to the questions '*What phases can be distinguished within the design and implementation process of an EPM solution in practice?*', '*What steps or activities can be executed when designing and implementing an EPM solution in practice?*' and '*What methods and techniques can be used to support these steps or activities in practice?*'.

The chapter ends with a summary and discussion of the current practices. The discussion shows the degree of which this chapter provides answers to the research questions as stated above.

4.1 Enterprise performance management system models

This section summarizes EPM models as used in practice. It is split in two parts: models retrieved from the interviews and models from EPM software vendors. Models from EPM software vendors are included since some of the respondents implement these software packages at their clients. At the end of this section a comparison is made between all of these models.

4.1.1 EPM system models related to interviews

In the interviews questions were asked to discover what an EPM system should look like in terms of system elements. As a response to this some of the respondents provided PowerPoint presentations and brochures. Some respondents also wrote books about the subject. One of these was obtained, and the EPM system model from this book has been incorporated in this section. The view of respondent 2, as extracted from his PowerPoint slides, can be seen in Figure 21. The elements of an EPM system are clearly defined within this model.

Figure 21 - EPM system model [respondent 2]

The slides of respondent 2 also included a 'business performance solutions footprint', visualizing the elements the final solution should have (see Figure 22). The source of the model lays at Forrester Research, Inc. [Ham07] In correspondence to the other respondents, it is suggested that the solution must have a data warehouse with several layers on top of it, normally visualized by a dashboard and/or a portal. EPM can serve as a supplement of existing applications like ERP or CRM. This is partly because these solutions lack management information (see Appendix C: Additional interview data).
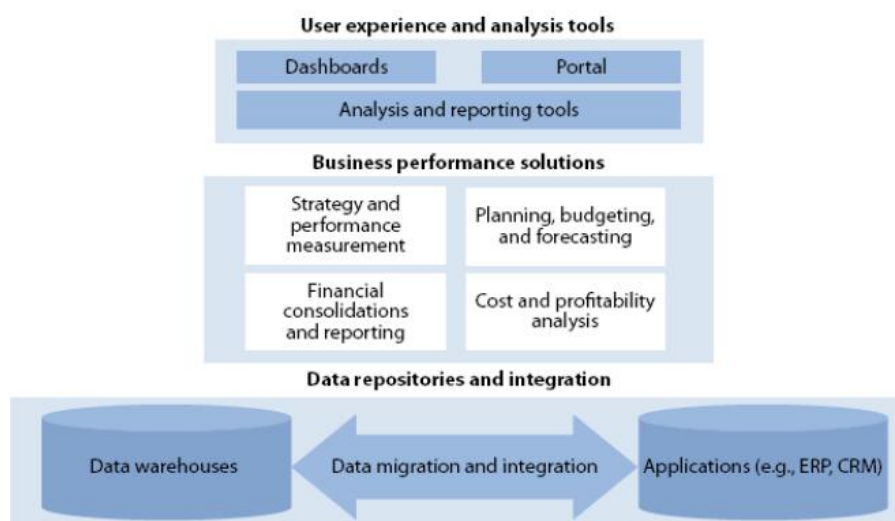
Figure 22 - Business performance solutions footprint [Ham07]

Within their book Geelen and Van de Coevering [GC05] mention a generic model for performance management tools. This model envisions the common way PM tools are built. As one can see in

Figure 23, it consists of three layers: data warehousing/business intelligence, EPM elements and web/portal.
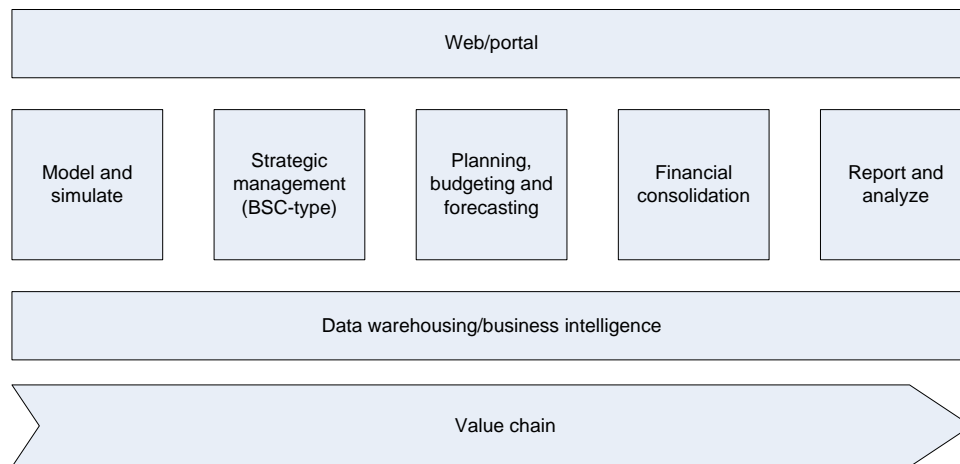
Figure 23 - Generic model for performance management tools [GC05]

The module 'model and simulate' is used to create insights of the consequence of executing different alternatives. The module can, for example, improve the job of target setting. 'Strategic management' is the module where KPI`s are represented, e.g. by the use of the balanced scorecard. The strategy is practiced within the 'Planning, budgeting and forecasting' module. With the use of the module 'Financial consolidation' the correctness and completeness of financial information is tested. Automatic calculations are performed and information is sorted and ranked. The module 'Report and analyze' enables the user to create reports and make analysis of performance information.

Other remarks of the respondents about the structure of an EPM system include:

- The elements of an EPM system should look like those of the Balanced scorecard
- It must have a dashboard
- It must have a data warehouse
- It has the operational structure of data -> information -> knowledge
- The system must have several layers

4.1.2   EPM system models from software vendors

Within this paragraph a summary is provided of EPM models from the three leading vendors of EPM systems (according to Gartner research [CRD08]).

4.1.2.1   Oracle

Figure 24 shows the system model of Oracle [Ora08]. The training 'Oracle EPM Hyperion Planning' has been attended to get insights of EPM applications in practice. Within this training and conversations with staff of Oracle, it became clear that Oracle does not provide a complete roadmap of EPM design and implementation. The development of a complete EPM system has not been finished up to now, partly due to the reorganization after the acquisition of Hyperion. [LB07]
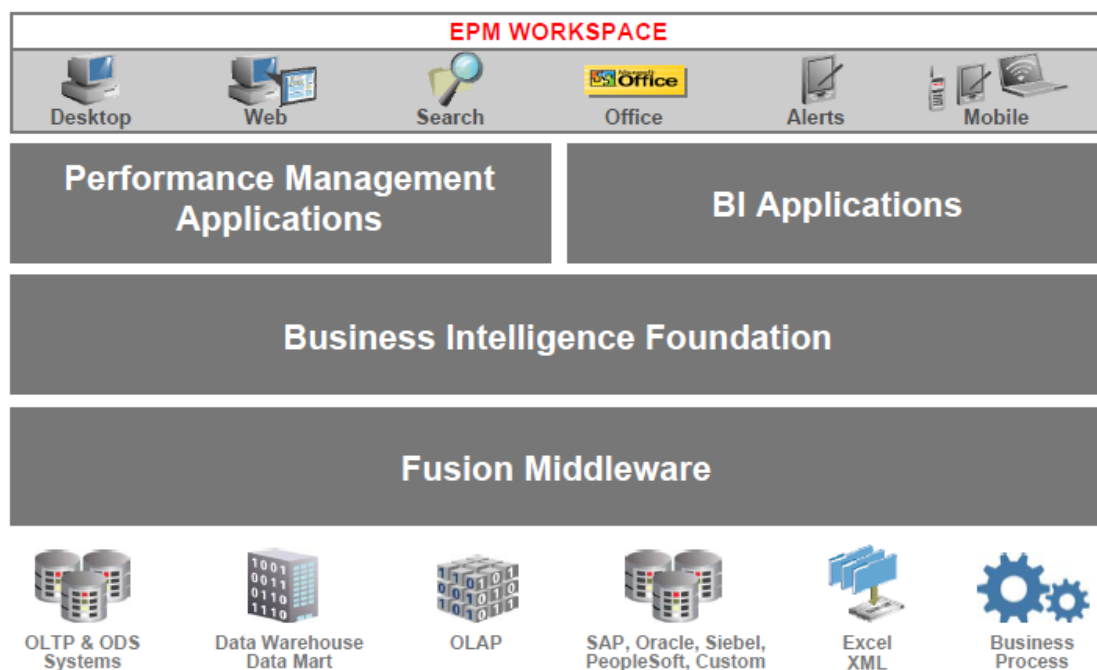
Figure 24 - Oracle EPM system model [Ora08]

4.1.2.2   IBM Cognos

Figure 25 shows the IBM Cognos corporate performance management system [IBM09]. In comparison with the Oracle model, it also consists of several layers, using services to execute performance management solutions. It is claimed that each industry has its own specific challenges for EPM. For example 'supply chain planning' is a big challenge within the manufacturing industry, as well as 'mortgage banking' in the financial industry. Therefore the makers of the model made a distinction between industry specific solutions and business function solutions. Business function solutions are not industry specific and can be applied within most companies.

Within the 'performance management platform' level, the elements of an EPM system are situated. 'Event management' is the management of alerts and notifications of business activity.

The software of the 'performance management solutions' layer should support these elements. The underlying 'open platform services' layer serves as the integration layer. Herein services are located to make the EPM system executable. The 'data sources' layer provides the data needed to execute these services.
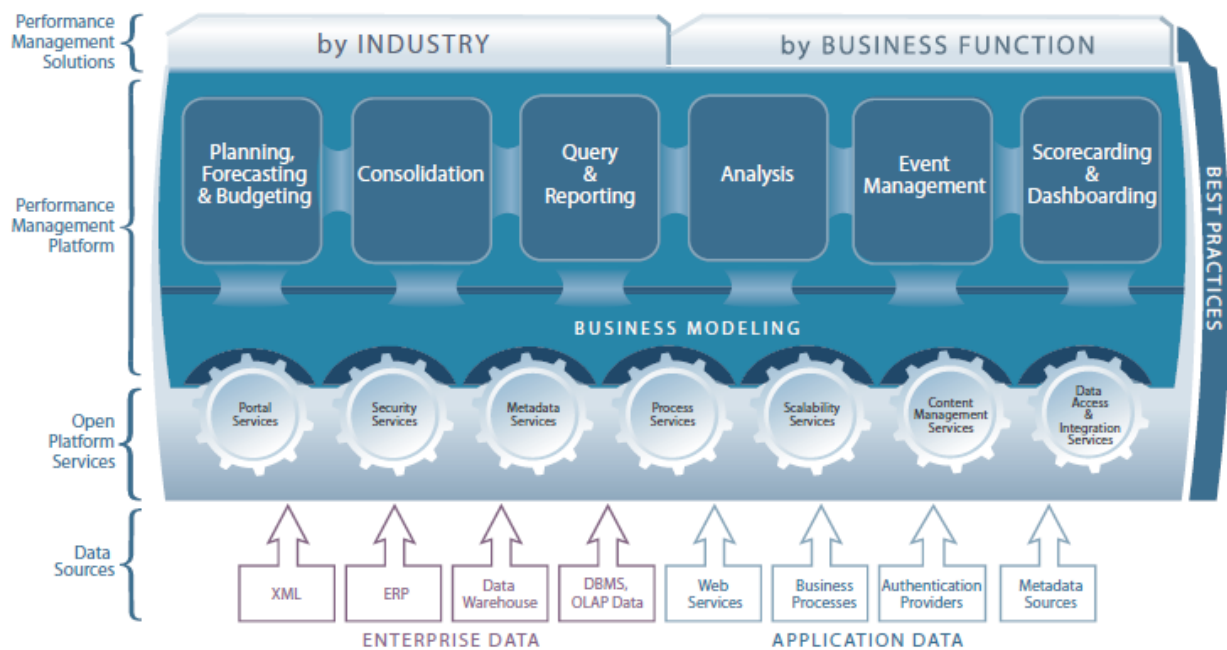
Figure 25 - IBM Cognos corporate performance management system [IBM09]

4.1.2.3 SAP Business Objects

The last model of this section is the performance management model of SAP Business Objects, as displayed by Figure 26 [Wei04]. It is structured differently from the other models by incorporating fewer elements. Since Business Objects was recently acquired by SAP, it is expected that Oracle`s enterprise performance management system will undergo some changes. [SAP08] It should also be noted that the model is relatively old (November 2004).

The website of SAP Business Objects gives some additional insight in the performance management applications within the performance management part of the model. These are listed below.

- Strategy management
  With strategy management, one can set goals, map strategies, and then monitor and manage performance from high-level objectives down to operational metrics. [SAP09]
- Planning, budgeting and forecasting
  This module is used to produce more accurate plans and budgets, create rolling forecasts, and incorporate real-time actuals with historical data analysis. [SAPA09]
- Consolidation
  The consolidation module is used for management reporting and decision making [SAP09], and to centralize all performance-related data to ensure compliance. [SAPA09]
- Profitability & cost management
  Causes of underperformance are identified, whereby actions can be taken to reduce costs and optimize profitability. [SAP09]
- Spend and supply chain performance management
  This module is used to gain insights into company-wide spending patterns, savings potential, and external market factors. Operational process metrics that affect the supply chain are included to improve the supply chain effectiveness. [SAP09]

Figure 26 - SAP Business Objects performance management model [Wei04]

4.1.3   Comparison of models

The EPM system models both related to the interviews and the software vendors are compared to come up with a general EPM model. The layers of this model are depicted in Table 9. The layers 'view', 'elements', 'integration' and 'data' have been extracted by searching for the common denominator of the layers from the recovered system models. Within the 'data' layer the data sources for the EPM system are located. The 'integration' layer combines these sources for example by providing services. The 'elements' layer consists of the different components the system must support. Within the 'view' layer users or programs can access the system. For example a web portal can be part of this layer.

Table 9 - EPM system model layers

	view	elements	integration	data
Business performance solutions footprint				
user experience & analysis tools	✓	✓		
business performance solutions		✓		
data repositories and integration			✓	✓
Generic model for performance management tools				
web/portal	✓			
EPM elements		✓		
data warehousing/business intelligence			✓	✓
Oracle EPM system model				
EPM workspace	✓			
performance management/BI applications		✓		
BI foundation			✓	
fusion middleware			✓	
data layer				✓
IBM Cognos corporate performance management system				
performance management solutions		✓		

performance management platform	✓		
open platform services		✓	
data sources			✓
SAP Business Objects performance management model			
performance management	✓	✓	
BI platform	✓	✓	
data integration		✓	

As mentioned before, within the 'elements' layer the components of an EPM system are located. Table 10 summarizes these elements per model. Again the common denominators from the recovered system models are used to come up with the elements of the EPM system model.

Table 10 - Comparison of EPM system model elements

	strategy management	reporting	analysis	forecasting	planning	budgeting	financial consolidation
EPM system model (respondent 2)							
strategic planning	✓				✓		
target setting	✓						
planning & budgeting					✓	✓	
forecasting				✓			
financial consolidation & reporting		✓					✓
BI & insight			✓				
Business performance solutions footprint							
strategy & performance measurement	✓						
planning, budgeting and forecasting				✓	✓	✓	
cost and profitability analysis			✓			✓	
financial consolidations and reporting		✓					✓
Generic model for performance management tools							
strategic management	✓						
planning, budgeting and forecasting				✓	✓	✓	
financial consolidation							✓
report and analyze		✓	✓				
model & simulate			✓	✓			
IBM Cognos corporate performance management system							
scorecarding & dashboarding	✓						
planning, forecasting & budgeting				✓	✓	✓	
(financial) consolidation							✓

query & reporting		✓				
analysis			✓			
event management		✓				
SAP Business Objects performance management model						
reporting		✓				
query and analysis			✓			
strategy management	✓					
planning, budgeting and forecasting				✓	✓	✓
consolidation		✓	✓			
profitability & cost management						✓
spend and supply chain PM			✓			

4.2 Factors influencing the method

Within this paragraph the factors influencing the method to design and implement EPM are summarized with the help of the critical success factors and the 'EPM view'. The latter is incorporated to understand the influence of the companies' organization and management method on the EPM method.

4.2.1 Critical success factors

In each of the interviews the respondents were asked what they believe are the critical success factors (CSFs) of EPM. Table 11 provides a summary of these CSFs and compares these factors with the factors found in literature (see chapter 3.3.1). Hereby per (numbered) respondent the CSFs are listed and compared. We tried to map the CSFs to the factors from literature as best as possible. As one can see, the CSFs derived from the interviews can all be sorted beneath the factors from literature. One should note that the use of an 'evolutionary development methodology' was not mentioned by the respondents as being critical to EPM success. This could be explained by the fact that most of the respondents create the methodology themselves and assume this is done properly. Another explanation is that a lot of projects do not have a complete development methodology ready at the start of the project. In that case the project is executed on a more ad-hoc basis, dependent on the client`s wishes and the restrictions of the project.

Table 11 - Critical success factors of EPM from practice

	champion	management of resistance	management support	sufficient resources	team skills	user support	effective communication	clear link to business strategy	data management infrastructure	development methodology
1										
create support						✓				
management commitment			✓							
awareness		✓								
have a good structure									✓	
quality of data & logistics									✓	
push management reports									✓	
2										
awareness		✓								
management commitment			✓							
resources & finance				✓						
have someone to carry out the EPM view	✓									
used technique (IT related)									✓	
communication							✓			

link to long term strategy				✓	
3				
have an internal organizational facilitator	✓				
culture		✓			
leadership style	✓				
cooperation		✓			
commitment		✓			
4				
finance			✓		
technical possibilities			✓		✓
good project team				✓	
commitment IT solution				✓	
management commitment		✓			
measures must be SMART[3]				✓	
5				
clear expectations		✓			
availability data			✓		
availability people			✓		
budget			✓		
unambiguous definition of data and formula					✓

4.2.2 EPM View

Enterprise performance management is all about managing the company the best way possible. To do so, different ways exist by incorporating different managerial views. The respondents noted that these different views have influence on how an EPM system should be designed and implemented. In summary, the respondents mentioned the views 'functional focused', 'process focused' and 'functional & process focused'. These views are elaborated in this paragraph.

4.2.2.1 Functional focused

When approaching EPM in a functional way, the business is viewed as a set of separate functional units each responsible for its own performance. For example the unit 'inventory' is responsible for the stock and must try to keep the store costs as low as possible. The unit 'sales' is responsible for the amount of goods sold and cannot be held responsible if the profit slinks due to high store costs.

With this view the company`s objectives and key performance indicators (KPI`s) are set by combining the ones from each of the functional units. Within this view, EPM can be introduced at separate functional units, only at the top layer of the organization, or at the whole organization.

4.2.2.2 Process focused

Another view the respondents mentioned is the focus on processes within the company. Hereby the business processes are subject for the design of the EPM system. A lot of attention is given on the processes which add value to the customers. The respondents use methods like 'Lean Six Sigma' to

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[3] Specific Measurable Achievable Relevant Time-bound [Hol05]

analyze the company and to set up an EPM system. A more flattened organization structure is required wherein communication and transparency is key for the project`s success. Process owners are responsible for the execution of the strategy, and business process improvement is one of the most important aspects of the EPM system. The respondents state that if a company currently does not focus on processes, it must change its management to make EPM implementation possible.

4.2.2.3   Functional & process focused

A different respondent believes one should focus on both processes and functional units within an organization. Hereby objectives from both viewpoints are combined, giving focus to the information flow within the company. The respondent did note that it is quite complicated to set KPI`s acceptable enough for both the process owners as the managers from the functional units. Therefore some discussions may occur when designing the system.

4.2.2.4   Comparison EPM view with literature

The respondents mentioned three views to set up an EPM system: functional focused, process focused and a combination of both. Similarities of these views can be found with the approaches to structural design from paragraph 3.3.2.1. The view 'functional focused' is similar to the vertical functional approach, whereas both are based on the organization`s functions. The view 'process focused' is similar to the team-based structure, both being organized around core work processes. The 'functional & process focused' view can be compared to the matrix structure, where a functional organizational structure is mixed with a process-based structure.

4.3   EPM method

4.3.1   Phases and steps

The respondents mentioned several phases and steps in the interviews. Whereas it appeared to be difficult to distinguish between steps and phases merely by analyzing the interviews, a combined summary is made within Table 12. Per (numbered) respondent the phases and steps are listed. The mentioned phases and steps are categorized according to the common denominator, creating the phases of EPM (as shown in **bold**). The derived phases are categorized within the PDCA cycle (see paragraph 3.4.3). Note that the phases and steps within the 'check' and 'act' phases are actually outside of the scope of this research.

Table 12 - Phases and steps of EPM derived from interviews

		1	2	3	4	5
PLAN	**Prepare**	create awareness to start EPM		preparation	diagnose	business analysis
		set project objectives			problem analysis	problem analysis
	Analyze business	gather (strategy) information	analyze	analyze	analyze strategic documents	information analysis
		gather financial & client objectives	gather management information	analyze market position		
		analyze work floor processes				
	Develop business strategy	determine mission	develop strategic plan	develop strategy	determine mission	set business objectives
		determine strategic objectives			determine vision	
		set KPI`s				
	Develop EPM strategy		develop EPM strategy	develop EPM strategy		make information plan
				plan project		make plan of approach
	Design system	improve processes	develop data model	determine CSF`s	determine CSF	develop solution alternatives
		create transparency	determine processes	system design	set KPI`s	
			select software package	translate strategy to dashboard	determine process changes	
			system	optimize		

			design	processes		
			consolidation			
			realization			
			test			
DO	**Implement**	implement review structure	roll-out	implementation	technical realization	roll-out
			training	training/ follow-up		testing
CHECK	**Monitor & analyze**					evaluation
ACT	**Adapt system**					make adjustments

4.3.2 Activities

The interviews provided additional insights about activities which should be executed when designing and implementing EPM. These activities appear to be quite generally practiced and are not specifically intended for EPM. However, one should keep these activities in mind when starting an EPM project. The activity focus areas are listed below:

➢ Project management
➢ Project portfolio management
➢ Program management
➢ Change management
➢ Risk management
➢ Quality assurance

4.3.3 Roles & responsibilities

Different people and groups were mentioned in the interviews to show who should be incorporated when executing an EPM project. Table 13 gives a summary of the roles within an EPM project, the persons who should execute these roles and the responsibilities of these roles. To come up with this overview, the answers of the respondents are compared and combined according to the common denominator. Obviously, the involvement of a consultant regularly reappears because most of the respondents work as consultant.

Table 13 - Roles in an EPM project

Role	Persons involved	Responsibilities
Initiator	general manager, CIO, divisional director	often responsible for project
Coach	consultant	analyze company and guide EPM project
Project leader / program manager	internal manager (possible combined with external manager)	lead project
Strategy group	consultant, management team, all management layers, technical team, involve end user when it has a big impact	develop strategy, KPI`s
Project team	consultant, process owners, team leaders, operational staff	execute project
Organizational facilitator	internal employee	information provider
Feedback group/works council	process owners, organizational representatives	monitor project, approve decisions made, provide feedback, create support
Steering committee	higher management	approve intermediate products
Champion	CFO or someone else high positioned	create support
Builder	IT-department, external party	implement system
End user	user of the system, e.g. local managers	acceptance tests, verify working of system
Trainer	consultant	(end)training

4.3.4   Methods & techniques

This paragraph provides a summary of methods and techniques to be used within the EPM design and implementation process. The methods and techniques are arranged according to the phases in which they are used. The phases are derived from the PDCA cycle, as previously mentioned in chapter 3.4.2.1. However, these phases are used slightly different by placing system design methods and techniques at the 'do'-phase. This is done to underline the difference between methods and techniques used in the planning stage of the EPM projects and the methods and techniques used when actually designing an EPM system.

4.3.4.1   *Plan*

The planning phase is used to prepare and plan for the actual realization of EPM. The respondents mentioned the methods and techniques as illustrated by the textbox. An EPM maturity model is a method to describe at what level the company has implemented EPM. It is used to determine the steps needed to come to the right level of EPM implementation. The maturity model is more thoroughly dealt with in chapter 4.4, where the proposed

> ➤ EPM maturity model
> ➤ BI-maturity scan
> ➤ EPM roadmap
> ➤ Time-boxing
> ➤ Contract responsibilities
> ➤ Proof of concept

approach is presented. A BI-maturity scan is similar to the EPM maturity model, with the difference being that the Business Intelligence (BI) level of an organization is mapped. An EPM roadmap is also used to help implementing an EPM system. Time-boxing is used to cut an EPM project in different

parts with their own deadlines. It is used to keep the duration of the project under control and to make sure enough resources are available to complete (parts) of EPM. Legally contracting responsibilities can be used to ensure enough resources are available and to get management involvement by making sure they are the ones responsible for the project. A proof of concept can be used to underline the advantages of the system for reducing employee resistance and to gain support.

4.3.4.2 Do

Within the 'Do' phase the EPM system is designed. To gain information, to determine the strategy and to determine KPI`s, different methods and techniques can be used. The respondents mentioned using interviews and workshops for this reason. Templates can be used to structure the results, and also PMS models (see chapter 3) are used to model the measures to be taken. A strategy map can be used to get the company`s strategy right, and a KPI tree can be used to visualize the relationships of KPI`s and to prioritize them. A technique called 'Gemba' can be roughly explained as the process of going to the work floor and seeing how things are done. Management games, simulation games and '3-minute manager' are used to determine and

> - Interviews
> - Workshops
> - Templates
> - PMS models, f.e. BSC
> - Strategy map
> - KPI tree
> - Gemba: go-and-see
> - Management games
> - Simulation games
> - 3-minute manager
> - Dashboard

evaluate the strategy. The '3-minute manager' technique can be explained as: "you are the manager and you have three minutes to explain how things are going. What information do you want to explain within this timeframe?" [respondent 3] The result gives an indication about what management information is needed. The last method is the design of a dashboard, visualizing the information provided by the solution.

4.3.4.3 Check

Within the 'Check' phase the designed solution is evaluated. This can be done by the use of benchmarking techniques, thus to compare the solution with similar solutions. The respondents also mentioned user satisfaction investigations to check if the end

> - Benchmarking
> - User satisfaction investigations

users are content with the system and if the (potential) resistance of the employees has been reduced.

> - Web-based training

4.3.4.4 Act

The respondents only mentioned web-based training as a technique or method to be used within the 'Act' phase. Herein the users are trained to work with the system via the internet. The respondents state that this must be an interactive training, making sure the users utilize the system in the correct way.

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4.4   Conclusion and discussion of current practices

The current practices were described according to the framework of paragraph 2.3. Each of the results of the interviews can be arranged within this framework, supporting the statement that the framework provides a sufficient overview of enterprise performance management (EPM).

The set up of the framework was intended to provide answers to the research questions. The first research question answered within this chapter is '*What are the properties of an EPM solution in practice?'.* Within paragraph 4.1 EPM models related to the interviews and model from software vendors were compared to visualize and derive properties of an EPM system. These models have a lot of overlap, providing substantial information about the layers and elements of an EPM system.

Paragraph 4.2.2 ('EPM view') showed that different experts in the field have different views on EPM, i.e. it can be approached in different ways. This implies that more than one sort of EPM solution exists having different properties. It is proposed that properties of an EPM solution are also dependent on the level of maturity, as the experts state that different levels of EPM maturity exist (see 'Methods & techniques').

Other properties of an EPM solution are roles & responsibilities as described in paragraph 4.3.3. In addition, an indication was given on which persons should be included in an EPM project. This list was created with the evidence from the interviews. Because only experts on EPM and no client who have already implemented EPM were consulted, the completeness and validity of the found roles & responsibilities are ambivalent.

The answer to the research question '*What are constraints one has to deal with when designing and implementing an EPM solution in practice?'* was given in paragraph 4.2. As the paragraph explained, the critical success factors (CSFs) derived from the interviews can all be sorted beneath the factors from literature. Therefore this research confirms the validation of the list of constraints from literature in practice.

Paragraph 4.3.1 was included to answer the question '*What phases can be distinguished within the design and implementation process of an EPM solution in practice?'.* Again the plan-do-check-act cycle was useful to arrange the phases and steps. As a result of the analysis, eight phases of EPM were discovered. From these eight phases six are about the design and implementation of EPM. Each of these discovered phases are supported by at least three of the five respondents.

The question '*What steps or activities can be executed when designing and implementing an EPM solution in practice?'* is answered within paragraphs 4.3.1 & 4.3.2. The steps should be executed within the phases of EPM design and implementation. The derived activities are those which are generally practiced and are not specifically intended for EPM. However, these activities can be made more specific for explicit use within EPM projects.

The last research question dealt with is '*What methods and techniques can be used to* support these steps or activities in practice?'. An answer was given in paragraph 4.3.4, wherein the methods and techniques are summarized per phase. Because these were primarily derived from five interviews, it is most presumable that not all possible methods and techniques are mentioned. However, instead of supplying a comprehensive list of all possible methods and techniques it does give an overview of those methods and techniques which can be used within the different phases.

5   Solution design

Within this chapter the results from the literature review (chapter 3) and the analysis of current practices (chapter 4) are combined to come to an answer to the main research question '*What can be a method towards the design and implementation of an enterprise performance management solution, and what are the properties of this solution?*'.

The validity of the conceptual framework from chapter 2 was not contradicted after both the completion of the literature review and the analysis of current practices. Therefore the solution is also structured according to this framework. This chapter proposes an enterprise performance management (EPM) system model derived from the analysis of current practices (paragraph 5.1). This model gives some insights about how an EPM system could look like in practice, and what its properties are.

After the visualization of an EPM system in practice, the implications of factors influencing the method for EPM design and implementation are given (paragraph 5.2). As in previous chapters, a distinction is made between critical success factors and 'EPM view'.

The third paragraph (paragraph 5.3) presents the core of the solution design, i.e. the actual method to design and implement EPM. This entails the combination of the results from the literature review and the analysis of current practices.

At the end of this chapter a conclusion and discussion of the solution design is provided (paragraph 5.4).

5.1 Enterprise performance management system model

As a result of the comparisons of current practices (paragraph 4.1.3), the EPM model as depicted by Figure 27 has been developed. It contains the layers and elements which most occur within the analyzed EPM models.
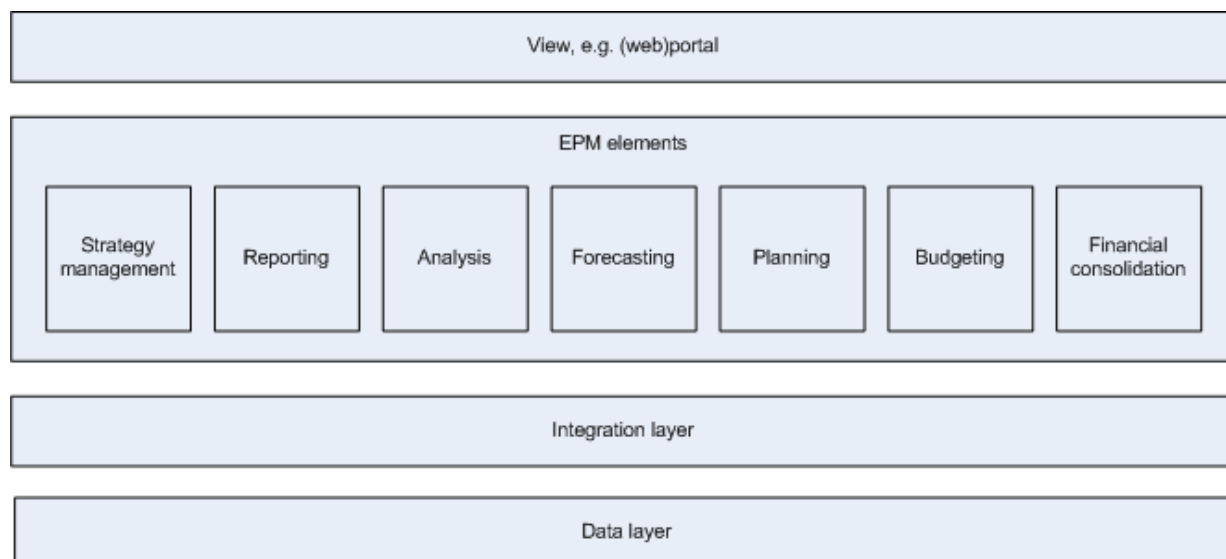
Figure 27 - EPM system model

Within the 'data' layer the data sources for the EPM system are located, e.g. data from ERP systems, Excel sheets and data warehouses. The 'integration' layer combines these sources, for example by providing services. The 'elements' layer consists of the different components the system must support.

Within the element 'strategy management' the business strategy is located, making it possible to view and adapt the business objectives, key performance indicators and targets. The progress of achieving the targets can be monitored and interferences can be made where necessary. Actions and initiatives are documented and appointed to objectives and their measures. For example one can appoint the action 'send a notification to the production unit to increase production of X' when the measure 'number of product X sold' comes above a certain value. Hereby the cause-and-effect links of each of the key performance indicators are shown.

The 'reporting' element is used to create and communicate performance reports. The experts note that these reports should be 'pushed' to the management, for example by automatically emailing PDF[4] reports on a weekly basis or when a measure comes above a certain threshold point.

Within the element 'analysis' information can be analyzed. When for example the performance of the sales department falls short, one can analyze the source of this by using the 'analysis' element. It could be that person A from sales visits 100 clients and sells 60 products. On the other hand person B visits 50 clients and sells 40 products. When purely looking at the sales numbers, person A performs better than person B. However, it is person B who performs better because he has a higher success

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[4] Portable Document Format (PDF) is a file format for document exchange

rate. When analyzing this information, the manager can decide to send person B to more clients and to keep an evaluation with person A to try to improve his success rate.

With 'forecasting' a prognosis is made and the consequences of managerial decisions can be simulated. Different alternatives can be evaluated and the best option can be chosen. This results in an update of the targets located within the 'strategy management' element.

The 'planning' element is added to integrate planning enterprise wide. The results of the 'forecasting' element are used to make more accurate plans. For example when the 'forecasting' element notices an increase of popularity of a certain product for the month May, the production planning of April can be adjusted to have enough products in stock.

As a result of the reports, planning and forecasting, financial plans are made within the 'budgeting' element. Hereby the budgets must correspond with the objectives and their targets.

The element 'financial consolidation' helps to gain insight in the company`s spending patterns. It centralizes all financial data to ensure compliance. Hereby Daft [Daf03] defines compliance as "*workers will obey orders and carry out instructions, although they may personally disagree with them and may not be enthusiastic.*" The consolidation of financial information ensures that there is only "*one version of the truth*" [Dre08].

The top-level of the EPM system is the 'view' layer with which users or programs can access the system. For example via a web portal a user can see a dashboard wherein the company`s current performance is visualized with the help of some color schemes.

5.2 Factors influencing the method

This paragraph states the implications of both the 'EPM view' and the critical success factors for the method to design and implement EPM. It is a direct result of the review of literature and the analysis of current practices.

5.2.1 Critical success factors

Within paragraph 3.3.1 the constraining factors to design and implement an EPM system were summarized. These factors were compared to the critical success factors (CSFs) mentioned by the experts in paragraph 4.2.1. This comparison showed that the CSFs from literature are supported by the analysis of current practice. The list provided within this paragraph shows the implications of these CSFs for the method to design and implement EPM. The results of these implications for the method can be extracted from `Appendix F: Traceability matrices`. Herein it is made clear that the CSFs especially influence the design of the `supporting activities`.

➢ Champion
The quest for a champion should be started in a preparation phase, where the EPM project is started. The role of champion must be filled within the project, e.g. by the CEO or CFO.

➢ Management of Resistance
To manage resistance, users must be prepared and involved in the project. Depending on the size of the project, users should be involved at different stages of the project. The CSF 'management of resistance' thus influences the roles & responsibilities. Also a preparation phase must be included to detect possible resistance and to prepare people for the arrival of EPM. Within this phase people should be approached to get them to understand the advantages of the system.

➢ Management Support
To get management support, the same requirements exist as with the CSF 'management of resistance'. Management must become enthusiastic about the project, getting everyone involved.

➢ Sufficient Resources
When executing the EPM project, one must make sure enough resources are available to do so. People must be allocated and a sufficient amount of money must be reserved for the project. Therefore resource management must be included within the method.

➢ Team Skills
Team skills are important when determining the roles and responsibilities for the EPM project. Possible barriers must be foreseen when analyzing the business and setting the EPM strategy. When necessary, extra resources must be called upon. The method will therefore contain an activity were team skills are assessed.

➢ User Support
To get user support, users must participate in the project. User requirements and feedback must accurately be captured and communicated to the development team. This has

influence on the roles and responsibilities of the project, and also on the way information is communicated. A feedback mechanism must be developed and executed as well as a project reporting & approval model.

➢ Effective Communication

To promote effective communication, a clear communication plan must be made up front and roles and responsibilities must be determined.

➢ Clear Link to Business Strategy

The development and maintenance of the business strategy plays a crucial role in EPM. Whereas this link is already an integral part of EPM and thus of the method itself, this CSF has no extra implications for the method.

➢ State of Existing Data Management Infrastructure

Within the analysis phase of the method, the state of the existing data management infrastructure must be studied. This helps in the process of developing the EPM strategy and to design the EPM system.

➢ Evolutionary Development Methodology

The development methodology includes the method-to-be-designed. Also at the start of the project a plan must be made to approach the project and to reach consensus about how to put the project`s methodology in practice.

5.2.2 EPM view

The 'EPM view' is incorporated to understand how the companies' organization and management method influences the EPM method. When conducting an EPM project, the business must be analyzed to understand the organizational structure and to decide on the directions of the project. When determining the business strategy and the scope of the EPM project, one must choose whether or not to make changes to the structure and the company`s decision model. When changes are needed, business processes must be redesigned. This implies that activities must be incorporated within the method to support these changes. For example the implementation of the EPM strategy could require a certain level of information transparency, demanding a different organizational structure or decision model.

Within the analysis of the current practices, three views on EPM were found. A distinction was made between a functional focused view, a process focused view, and a combination of both views. To support these different approaches within the method, a distinction will be made between the design and implementation of the organizational structure and IT system, and the design of business processes and the IT system (see paragraphs 5.3.2.5and 5.3.2.6). The choice for an EPM view must be incorporated in the EPM strategy, as one will see in paragraph 5.3.2.4.

During the lifecycle of an organization, it may occur that switches are made between decision making models or organizational structures. For example an adjustment of the strategy could require changes in the structure of the organization. Therefore, a feedback loop will be included in the method to challenge the decision making model and organizational structure.

5.3 EPM method

The combination of the literature research and an analysis of the current practices led to the method to design and implement enterprise performance management (EPM). Within this section this method is proposed. This section starts with an overview of the developed model (paragraph 5.3.1), followed by a description of each of the phases (paragraph 5.3.2). Herein the steps to be executed within the phases are described. The 'supporting activities' are elaborated in paragraph 5.3.3. These include activities which were explicitly mentioned as being important within an EPM project by the addressed experts.

As one can review from the conceptual EPM framework of chapter 2, the method also consists of method & techniques and roles & responsibilities. These are elaborated in paragraphs 5.3.4 and 5.3.5, respectively.

The entire method is shown in Appendix E: Method towards the design and implementation of an enterprise performance management solution. Note that this version will be renewed during the evaluation (see chapter 6). This version can be recovered from Appendix I: Renewed method towards the design and implementation of an enterprise performance management solution.

5.3.1 Overview of the developed method

The phases of EPM design and implementation form the foundation of the developed method. The eight proposed phases and their relations are shown in Figure 28.

The literature study showed that the phases of EPM and performance measurement system (PMS) design and implementation can be structured with the help of Deming`s PDCA cycle [Dem86] (see paragraph 3.4.3.1). Therefore the phases of the EPM method can also be placed within the four elements of the PDCA cycle.

Because this research provides a method to design and implement EPM, the 'Check' and 'Act' elements of the PDCA cycle are not elaborated. To underline the continuous improvement aspect of EPM, these elements are incorporated in Figure 28. These are the phases seven and eight: 'monitor & analyze' and 'adapt system', respectively. After (and during) the implementation, the system is monitored and analyzed. KPI`s can be adjusted and targets are set. As a result, major changes in the system can be opted to require starting the whole process all over again visualized by the feedback loop.

As shown in Figure 28, the proposed method elaborates on the 'Plan' part of the PDCA cycle. The phases are added as a result of the analysis of current practices and the literature review, wherein several constraining factors one must deal with when setting up an EPM system were extracted.

The phases of the method are directly taken from the analysis of the current practices (see Table 12). The steps from the method are a result of the fusion of steps found in literature and current practices. 'Appendix F: Traceability matrices' shows the precise sources of the inclusion of the steps, both from literature and current practices. Later on, this section provides an explanation of the phases and the steps to be executed within these phases.

The complete model for EPM design and implementation can be recovered from Appendix E: Method towards the design and implementation of an enterprise performance management solution.
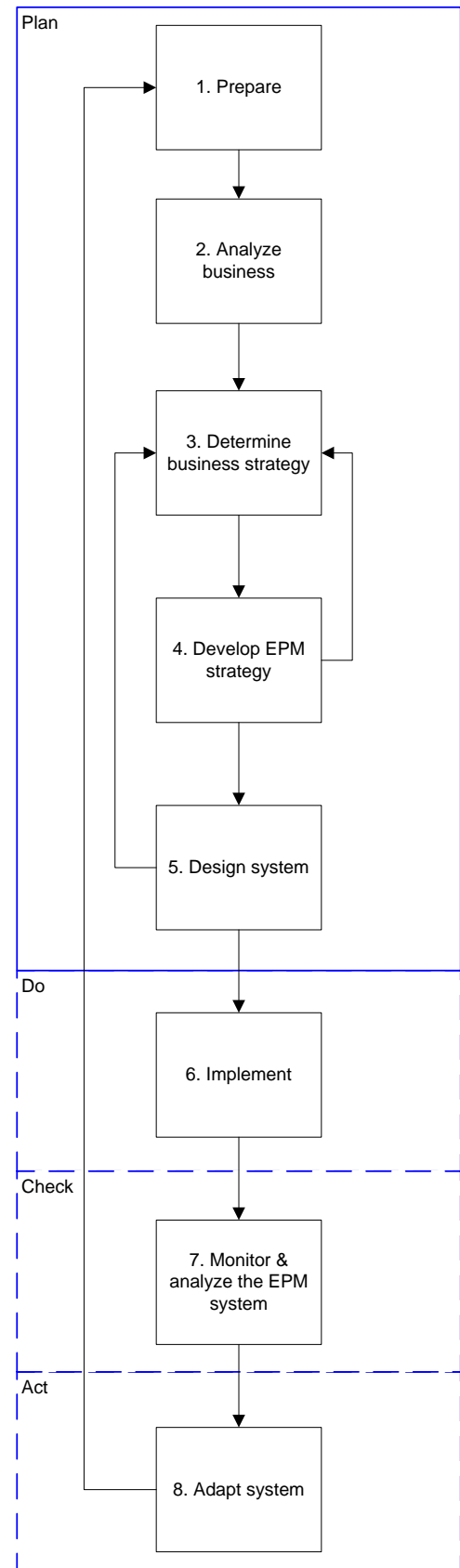
Figure 28 - Phases of EPM design and implementation

5.3.2   Phases & steps

This section describes the phases of the method and the steps to be executed within these phases. As mentioned before, these are derived from literature and current practices, complemented with some additions. The steps which are shown in a blue/white striped box are those which are executed dependent on the chosen EPM strategy. Within small projects these normally do not have to be carried out.

5.3.2.1   Prepare

The first phase entails the preparation for the project. Herein two steps are executed to set-up the project as depicted by Figure 29.

5.3.2.1.1   Start supporting activities

Supporting activities are started to make sure the project`s critical success factors are kept in mind. This includes for example the creation of awareness among personnel and the allocation of sufficient resources. These activities are elaborated in paragraph 5.3.3.

Figure 29 - Prepare

5.3.2.1.2   Develop initial project vision

At the second step of the preparation phase, the initial project vision is developed. Herein a preliminary problem analysis is done to understand what to solve with the introduction of EPM. The content of the project is roughly visualized, thus creating understanding of what the project is all about. This includes agreeing on the critical success factors of the project. At a later stage (the step `problem analysis') the project vision is further explored.
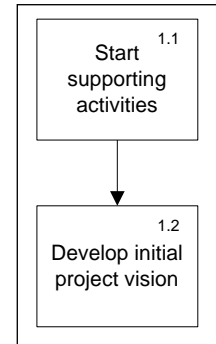
5.3.2.2   Analyze business

The phase called 'analyze business' is included to gain knowledge about the current situation. Within this phase information is gathered and analyzed after which the company`s EPM maturity is determined. The current EPM maturity plays a big role when determining the EPM strategy at a later stage. The results are used as input for the succeeding phases. The steps within this phase, as visualized by Figure 30, are explained below.

5.3.2.2.1   Gather information

During the first step of the phase 'analyze business' amongst others the following is gathered (as derived from the interviews and CSFs):

Figure 30 - Analyze business

- Strategy information (e.g. policy documents)
- Environmental/market/branch information
- Information about the value chain
- Information about the organizational structure (e.g. organogram)
- Information about used decision models/chain of control
- Business process information
- Information about the state of the existing data management infrastructure

5.3.2.2.2   Analyze information

After the required information is collected, it must be analyzed. This includes assessing the work floor processes and pointing out shortcomings. For example the existing data management

infrastructure may have flaws which must be solved with the introduction of EPM. There may be contradicting information and several versions of the truth. This step pinpoints these problems one needs to deal with at a later stage.

5.3.2.2.3   Determine EPM maturity

With the help of the gathered and analyzed information the current level of EPM maturity can be determined. This helps visualizing the current position of the organization to create the EPM strategy at a later stage.

5.3.2.3   Determine business strategy

After the business has been analyzed, the business strategy is created. In most cases, a company already has some kind of strategy. This strategy is not always written down, but often some strategy documents do exist.

The mission, vision and objectives of a company determines it`s strategy. This is done in succeeding steps, as depicted by Figure 31.

5.3.2.3.1   Determine mission

The first step in creating a strategy is to determine the mission. Ward and Peppard [WP02] define mission as "*an unambiguous statement of what the organization does and its long-term, overall purpose*".

5.3.2.3.2   Determine vision

After the company`s mission is clear, it`s vision is determined. Ward and Peppard [WP02] state that a vision is a picture of what the organization will be in the future and how it will operate. It brings the strategy to live and gives the whole organization a destination that it can visualize, so that every stakeholder has a shared picture of the future aim.

Figure 31 - Determine business strategy

5.3.2.3.3   Determine objectives

Within this step the mission and vision statements are specified by setting objectives. Herein the goals are set to take the company toward achieving its vision. [WP02]

5.3.2.3.4   Develop strategic plans

The last step, develop strategic plans, define the way in which the determined objectives will be met. As Ward and Peppard [WP02] denote, these plans "*frequently do not exist, and one of the ways in which an IS strategic process can help is in facilitating the identification and documentation of candidate schemes for achieving the objectives.*" Therefore within the implementation phase the step 'develop action plans to reach targets' is included (see paragraph 5.3.2.6.4).

5.3.2.4   Develop EPM strategy

When the business strategy is set, the EPM strategy is developed. The 'EPM strategy' can be seen as a (long term) plan or roadmap for EPM system design and implementation. It includes decisions about the level of EPM maturity at which the company wants to operate and the scope of the project. It can occur that the EPM strategy is in conflict with the business strategy. Therefore a feedback loop is incorporated to adjust the business strategy and/or the EPM strategy where needed. This is illustrated by Figure 32. The following steps are performed:

5.3.2.4.1   Problem analysis

With the help of the project vision and the business strategy, an analysis is made of the current problems one wants to solve with the EPM solution.

5.3.2.4.2   Design EPM strategy

A plan is made to solve the current problems and to envision and scope the EPM solution. As with the business strategy, it can have a mission, vision, objectives and strategic plans. For example one can choose to start with small EPM projects and merge these later on into one large EPM solution. Within this step decisions are made to determine the preferred EPM maturity level, the need for organizational restructure and the possible inclusion of business process optimization.

5.3.2.4.3   Evaluate EPM strategy

When an EPM strategy is made, it must be evaluated with all the stakeholders, compared with the business strategy and checked on its feasibility. For example conflicts may occur in the data management infrastructure, availability of resources or management support.

5.3.2.4.4   Adapt EPM strategy

As a result of the evaluation, it is likely that changes of the EPM strategy are required. Also due to new insights or conflicting objectives changes in the business strategy may be necessary.
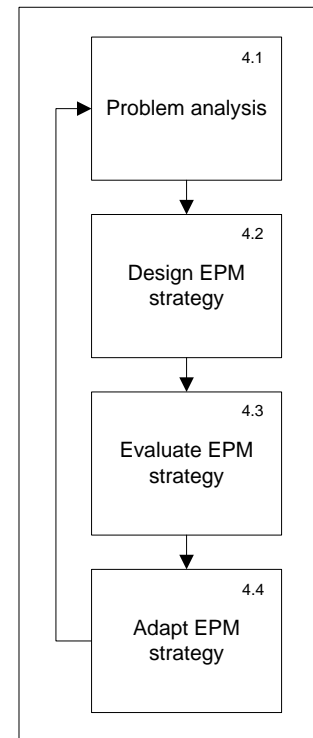
Figure 32 - Develop EPM strategy

5.3.2.5   Design system

The steps for the design of the system are shown in Figure 33. It is based on the PDCA cycle. The execution of the first two steps, 'design business processes' and 'design organizational structure' is dependent on the chosen EPM strategy. When the strategy includes business process optimization and organizational restructuring, these should be executed at the start of this phase. In that case, the system must be designed around the business processes. When new business processes are designed, the organizational structure must be adapted accordingly. This implies redesigning the organizational structure. Within this step, the chain of control and the information flow are determined.

After the possible redesign of business processes, measures are developed. These measures are a direct result of the set objectives in the business strategy and the objectives of the EPM strategy.

The designed measures play a big impact on the design of the IT solution. This design includes the design of all layers of the EPM system, namely the data layer, integration layer, EPM elements layer and the view layer. To design the system, one can choose to use a software package from an EPM vendor. In that case, software package selection is needed.

The design of the IT solution can have influence on the designed business processes. Therefore a feedback loop is incorporated. The design of the IT solution must also be used to evaluate the measures. It can occur that the developed measures cannot be executed with the designed IT solution or the solution provides extra insights for new measures. For this purpose, the steps 'evaluate measures' and 'adapt measures' are incorporated.

5.3.2.5.1 Design business processes

This step is executed when the EPM strategy requires a redesign of business processes in order to retrieve the correct data for measurement. It can also occur that processes have to be redesigned due to a change in business strategy or renewed insights in the organization`s performance. The latter should be done within a different project, which can run in parallel with the EPM project.

5.3.2.5.2 Design organizational structure

This step is executed when the EPM strategy requires a change in the organizational structure. For example when the EPM project requires the organizational structure to flatten, positions have to be reallocated and new communication plans must be made.

5.3.2.5.3 Develop measures

Measures, or key performance indicators, are developed to be able to assess the level on which objectives are met. The election of the measures is dependent on the technical possibilities, having a direct relation to the objectives set within the phase 'develop business strategy'. The cause-and-effect links between the measures and the objectives must be modeled, whereby the measures are sorted and grouped in a logical way.

5.3.2.5.4 Design IT solution

Within this phase the EPM system model as proposed within paragraph 5.1 can be used to design the IT part of the system. This must be done at several layers: 'view', 'elements', 'integration' and 'data'. Within the data layer the current data management infrastructure is reviewed and (re)designed. Hereby one makes use of the information gathered within the second phase, 'analyze business'. One can choose to design the complete system self, or make use of standard packages.

5.3.2.5.5 Evaluate measures

It may occur that the developed measures cannot be executed with the designed IT solution or the solution provides extra insights for new measures.
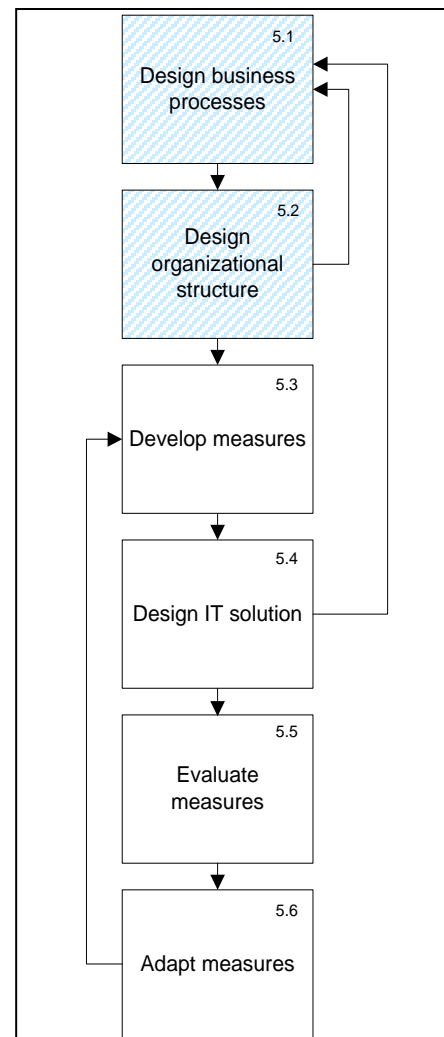
Figure 33 - Design system

An example: part of the business strategy is the objective 'increase client satisfaction'. To measure this objective, the decision is made to measure how long it takes to deal with one client complaint. However, when designing the IT solution it turned out to be technically impossible to measure throughput times. Therefore the new measure 'number of complaints' was developed.

5.3.2.5.6 Adapt measures

It is very much possible that new insights, conflicts with the business strategy, or other restraints like technical difficulties or a shortage of resources require change in the design of the measures. On its turn, this may require changes in the design of the IT system, starting the cycle all over again.

5.3.2.6   Implement

5.3.2.6.1   Develop implementation plan

To implement the system, first an implementation plan has to be developed. For example the switch from the old to the new situation can be done simultaneously or in small steps. Resources must be allocated and training programs must be started.

5.3.2.6.2   a: implement IT system; b: change organizational structure

After the implementation plan has been made, the implementation can be started. Dependent on the design, changes in the organizational structure are carried out in parallel with the implementation of the IT system.

5.3.2.6.3   Set targets

When the system has been implemented, targets are set for each of the measures.

5.3.2.6.4   Develop action plans to reach targets

Within the final step of the implementation phase action plans are made to reach the objectives as set in the business strategy. As mentioned in paragraph 5.3.2.3.4, these plans are part of the (renewed) business strategy.
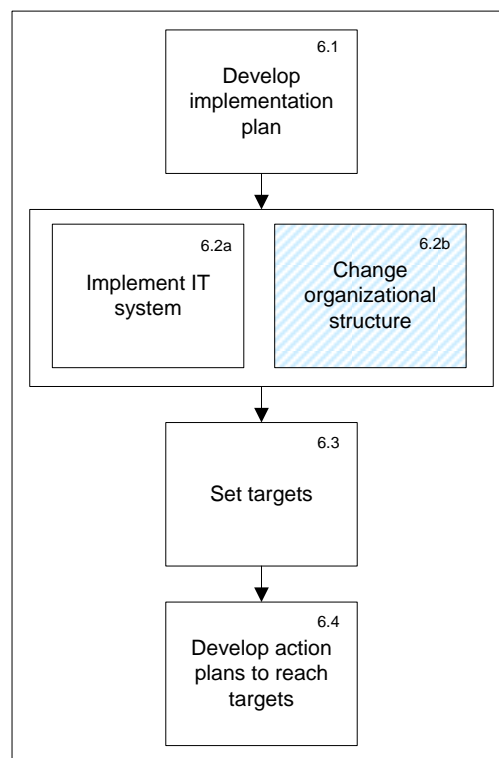
Figure 34 - Implement

5.3.3 Supporting activities

Within this section an explanation is given of the 'supporting' activities. These are activities which are not executed in a specific order or at a certain phase in the project belonging to a specific area. The included activities were especially mentioned during the interviews and are partly derived from the critical success factors of EPM projects. The source of these activities can be recovered from Appendix F: Traceability matrices.

5.3.3.1 Change management

Change management activities are performed to make sure employees accept the new situation and use the system(s) properly.

According to the critical success factors (see paragraph 5.2.1 & Appendix F: Traceability matrices), the following activities have to be executed within the preparation phase:

- ➢ Get management support
- ➢ Create awareness
- ➢ Search for a champion
- ➢ Detect resistance

The implementation phase includes the steps:

- ➢ End user training
- ➢ User support

The following steps are executed during multiple phases:

- ➢ Get employee approval
- ➢ Analyze impact of change

Note that within the step `end user training` users are trained how to work in the new situation, i.e. training is given on how to work with the new system and also on how to deal with the (new) role within the organization.

5.3.3.2 Project & program management

Within the current practices it was noted that one should have project, program and project portfolio management in place when introducing EPM. As De Reyck et al. [RCGL05] denote, project management focuses on single projects. Although the proposed method to design and implement EPM can be seen as a method to manage an EPM project, 'project management' is included within the supporting activities to highlight activities concerning the use of resources. This includes not only financial, physical and human resources but also the use of time, i.e. planning.

Program management is the "*management of a set of projects that are related by sharing a common objective or client, or that are related through interdependencies or common resources*". [RCGL05] When the developed EPM strategy state that several EPM projects must be executed in parallel, or if other projects are running while designing and implementing EPM, one must perform activities of program management.

 "*Project portfolio management considers the entire portfolio of projects a company is engaged in, in order to make decisions in terms of which projects are to be given priority, and which projects are to*

be added or removed from the portfolio." [RCGL05] Therefore when developing the EPM strategy one has to address which other projects are running within the company and how these are prioritized in comparison to the EPM project(s). Within the developed method to design and implement EPM, the prioritization of all projects running within a company is left out of scope. However, in order to make a plan of approach one must have some understanding of the company`s priority of the EPM project.

This resulted in the following activities of project and program management within the preparation phase:

➢ Design communication plan
In order to address the CSF 'Effective Communication', a communication plan must be made up front. Herein statements are made who should be informed and when.
➢ Set initial roles & responsibilities
Whereas no EPM strategy has been created yet, within the preparation phase the initial roles and responsibilities are set. This includes the formation of a project team and the appointment of a project leader and facilitator.
➢ Make plan of approach
The plan of approach is in fact the detailed methodology for the project, thus addressing the CSF 'Evolutionary Development Methodology'. The results of the other activities and steps to be performed within this phase may be incorporated in this plan of approach.
➢ Assess team skills
As the CSF 'Team Skills' denote, the success of the project is very much dependent on the skills of the team members. When analyzing the team skills in the preparation phase, problems can be pointed out at an early phase, making it possible to appoint more or better team members.

Activities within the phase 'develop EPM strategy':

➢ Set roles & responsibilities
When the EPM strategy has been determined, one knows precisely what roles & responsibilities are required to design and implement the system.
➢ Prioritize EPM projects
As stated before, when several EPM projects must be executed in parallel, or if other projects are running while designing and implementing EPM, one must perform activities of program management. Therefore one must prioritize the EPM projects to best manage and plan the project.

Activities executed during multiple phases:

➢ Resource management
Resource management includes the allocation of money, people and material. A project portfolio should be kept to assign these resources.
➢ EPM project planning

5.3.3.3   Quality assurance

To increase the probability of the company`s success, quality assurance activities are performed. Within the preparation phase these include:

➢ Develop feedback mechanism
To involve users in the process and to ensure the quality of the system, a user feedback system must be developed.

➢ Develop project reporting & approval model
To improve communication and decision forming within the EPM project, a project reporting & approval model must be developed. This states a.o. what must be reported, when and to whom.

Activities within the system design phase:

➢ End user testing
To improve user support and to test the EPM implementation, end user testing is incorporated.

➢ Design standards
To support users to use the system in the right way, standards are to be designed. This should ensure the quality of the system.

Performed activities within the implementation phase:

➢ End user training
As with the design of standards, users must be guided to correctly use the system. End user training should be done in order to fulfill this requirement.

➢ Design system guidelines
Guidelines must be developed to ensure proper use of the system.

Activity executed during multiple phases:

➢ Feedback & reporting/approval
As a feedback model and reporting & approval model are developed, these must be brought in action by executing this activity.

5.3.3.4   Risk management

To foresee and anticipate on problems in the EPM project, risk management activities are included. This is a continuous process which is executed during the whole design and implementation of EPM. To do so, the software risk management cycle of Boehm [Boe91] can be used (see Figure 35). It consists of the next six steps:

➢ Risk identification
➢ Risk analysis
➢ Risk prioritization
➢ Risk management planning
➢ Risk resolution
➢ Risk monitoring
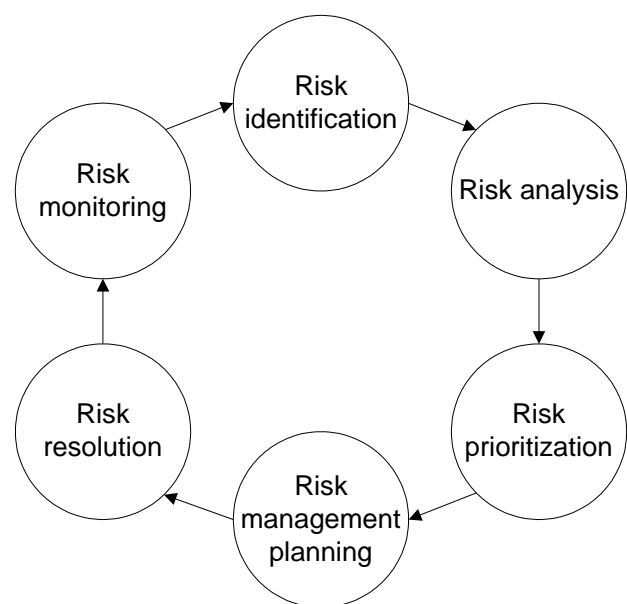
Figure 35 - Risk management cycle [Boe91]

5.3.4   Methods & techniques

In order to execute the steps and activities within the EPM method, diverse methods and techniques can be used. This section provides an overview of the ones which can be used at the different phases. The given methods and techniques are a combination of the ones derived from current practices and the literature review as treated in previous chapters. Some extra methods and techniques from other literature sources are added to complete the picture. These include amongst others the SWOT analysis and PEST framework.

5.3.4.1   Prepare

5.3.4.1.1   Contract responsibilities

To ensure sufficient resources are available and to force management support, responsibilities can be put in a contract. Herein the consequences of not meeting the requests are documented. For example when a project fails due to employee resistance, the external party which has done the design cannot be hold responsible for the project and gets paid. The company`s management normally wants to prevent this and will therefore put extra effort in the project for it to become successful.

5.3.4.1.2   Proof of concept

A proof of concepts (PoC) can be used to reduce employee resistance and to get management support. With this PoC a picture is given of how the system will look like in the future. It results in a better understanding of the advantages of EPM by the persons involved.

5.3.4.1.3   Time-boxing

Time-boxing is an integral part of the planning method by setting milestones. The project is separated in smaller parts to better manage costs, time and resources.

5.3.4.2   Analyze business

5.3.4.2.1   BI-maturity scan

Like the EPM maturity model, the BI-maturity scan is used to see what is already in place with regards to business intelligence (BI).

5.3.4.2.2   Interviews

To analyze the business, interviews with personnel on all management layers can be held. The technique helps to gain the information needed for the EPM project to work. Amongst others, it also helps to get support and detect potential problems.

5.3.4.2.3   Gemba: go-and-see

Gemba is a Japanese concept which means that one must go to the work floor and see what is done in practice. This should give more insight in the business processes and the company`s culture.

5.3.4.2.4   Value chain analysis

To gain insight in which processes add value to the company, one can do an analysis of the value chain. For example Porters value chain can be used to identify these processes.

5.3.4.2.5   Business analysis techniques

To analyze the business and its environment various business analysis techniques can be used. For example the SWOT and PEST analysis are common techniques to do so.

SWOT stands for Strengths, Weaknesses, Opportunities and Threats. [Dys04] With a SWOT analysis it is possible to identify the strengths and weaknesses of a company and the opportunities and threats in the environment. By identifying these factors strategies can be developed which may build on the strengths, eliminate the weaknesses, exploit the opportunities or counter the threats. [HLV99]

A tool to analyze the macro environment is the PEST framework. This framework identifies four environmental factors: political, economic, social and technological. [WP02] Within an EPM project one normally needs to cope with all these factors.

5.3.4.2.6   EPM maturity model

The analysis of current practices showed that maturity models are being used to analyze a company`s current state of EPM and to identify where the company wants to be. Thus an EPM maturity model can be used as a roadmap, indicating the directions in which a company can improve on the area of EPM. The model must have several levels of EPM maturity, similar to the strategic planning model of Gluck et al. [GKW80], the capability maturity model and the project maturity model of Grant and Pennypacker [GP06] (see Appendix G: Maturity Models).

Within the business analysis phase this model shows at which EPM level the company currently operates. In the 'develop EPM strategy' phase the level on which the company wants to operate is chosen. The EPM maturity model indicates what one must have implemented for a company to operate at a certain level, i.e. a kind of checklist of activities a company must perform to come to that specific level.

The development of an EPM maturity model is outside the scope of this research. However, the next bulleted list gives some suggestions for the model. It is based on the `EPM view`, current maturity models as depicted by Appendix G: Maturity Models, and the EPM system model.

- Incorporate at least three levels for it to be effective
- Differentiate between the implemented elements of EPM
- Differentiate between levels of transparency
- Differentiate between levels of integration and centralization
- Differentiate between the inclusion of business process management
- Provide a list of activities to be performed to arrive at a certain level
- Let the levels of the model deal with different types of organizational structure and decision models. For a complete EPM system to be implemented one should have a network structure where cooperation is encouraged and a learning organization is possible. This includes several feedback loops and open information distribution.

5.3.4.3   Determine business strategy

5.3.4.3.1   Interviews

To determine the business strategy, again the use of interviews is a common technique. Mostly managers are interviewed to get their view on the company`s strategy. The methods to design and implement performance measurement systems as provided by paragraph 3.4.2 showed how interviews can be used to help forming the strategy.

5.3.4.3.2   Workshops

As with interviews, workshops are a common technique to determine the business strategy (see paragraph 3.4.2).

5.3.4.3.3   Templates

As the analysis of current practices showed, templates can be used to formulate the strategy. Herein (parts of) the documented strategies from similar companies can help to formulate the company`s own strategy.

5.3.4.3.4   Strategy map

The use of a strategy map was suggested by Papalexandris et al. [PIPE05], who describe it as "a *graphical representation of the strategic objectives categorized according to the theme and perspective they represent, along with the cause and effect links between business performance drivers and outcomes in the different performance perspectives.*"

5.3.4.3.5   Management games

The respondents mentioned the use of management games to help determining the business strategy. It helps forming the business strategy in a playful way, e.g. by putting the managers in a different surrounding.

5.3.4.3.6   Simulation games

In a small scale the company is simulated at its current situation and where it wants to be. Within this simulation problems and opportunities that may occur are identified to define the company`s strategy. It helps validating the strategy the company has put on paper.

5.3.4.3.7   3-minute manager

The '3-minute manager' technique was explained by respondent 3 as: "*you are the manager and you have three minutes to explain how things are going. What information do you want to explain within this timeframe?*" The result gives an indication about what management information is needed.

5.3.4.4   Develop EPM strategy

The techniques and methods to develop the EPM strategy are very similar to those for developing the business strategy. Hereby interviews, workshops and templates are explicitly mentioned in this phase, but for example also simulation games are useful to develop the EPM strategy.

5.3.4.4.1   Interviews

See paragraph 5.3.4.3.1

5.3.4.4.2   Workshops

See paragraph 5.3.4.3.2

5.3.4.4.3   Templates

See paragraph 5.3.4.3.3

5.3.4.4.4   EPM maturity model/ EPM roadmap

Paragraph 5.3.4.2.6 already showed how an EPM maturity model should look like and how it can be useful when determining the EPM strategy. The preferred level of maturity is chosen, and suggestions are made for the activities to be performed.

5.3.4.5   Design system

5.3.4.5.1   Business process re-engineering

According to Kettinger and Teng [KT97] the election of techniques to be used within business process redesign (BPR) depends on the projects' characteristics. A project that requires a radical change, for example, has to put greater reliance on business planning than projects which entail less risk. Therefore the usability of BPR techniques within an EPM project is dependent on its EPM strategy.

As Reijers and Liman Mansar [RL05] note, prescriptive literature in the field sometimes advertised as "a step-by-step guide to business transformation" commonly lack actual technical direction to (re)design a business process. Therefore their research provides a checklist with best practices for process redesign, which also can be used within an EPM project.

An attempt to make a consolidated BPR methodology was done by Thong et al. [TYS03]. They did this by organizing the current literature and consolidating the various BPR methodologies, tools, techniques, and critical success factors into a generic BPR methodology that should be useful to managers interested in reengineering their firms as within an EPM project.

To summarize, one can use the work of Reijers and Liman Mansar [RL05], and Thong et al. [TYS03] when searching for methods and techniques for the application of BPR within an EPM project.

5.3.4.5.2   Benchmarking

When designing EPM, one can use benchmarking to compare business processes with one another. This can be part of business process re-engineering (as mentioned above), but also as a method to do software package selection.

5.3.4.5.3   User satisfaction investigations

User satisfaction investigations are applied to get user feedback. The results of the investigations are directly used to improve the design of the system.

5.3.4.5.4   Software package selection

One can decide to use a COTS[5] system as part of the EPM solution. Therefore one has to decide which software package to choose. To do so, software package selection helps determining which package best suits the required situation.

5.3.4.5.5   KPI tree

A KPI tree has great similarities with the goal tree from Wieringa [Wie03] which decomposes goals into sub goals. A KPI tree decomposes indicators into sub indicators whereby each level of KPI`s corresponds with a management level. This implies that for each level of sub indicators a different person is responsible. The experts denoted that a person can only manage up to seven indicators, limiting the number of KPI`s to seven for each manager. It is suggested that one can only steer upon seven things before it gets too complicated.

5.3.4.5.6   PMS models

As explained in chapter 3, performance measurement is intertwined with performance management. Therefore when designing an EPM system one also designs a performance measurement system

_____

[5] Commercial off-the-shelf, i.e. ready made products

(PMS). To do so, the models and frameworks from the literature review can be used. These include for example the balanced scorecard and the EFQM model.

5.3.4.5.7 Dashboarding

With the help of a dashboard the EPM solution can be visualized. Next, the EPM system can be build by using this dashboard as a basis. The dashboard itself will also be part of the final system. It can be structured according to a PMS model as mentioned in chapter 3, for example by using the different views of the balanced scorecard.

5.3.4.6 Implement

5.3.4.6.1 Web-based training

When the new EPM system is in place, users must learn how to work with it. Therefore the respondents denoted that one can use web-based training. This helps teaching the users to work with the system in an interactive way.

5.3.4.6.2 Implementation techniques

Several implementation techniques exist, for example the phased implementation wherein each part of the solution is introduced in phases to have users slowly adjust to the new style of working.

5.3.4.7 Supporting activities

Methods and techniques to execute the supporting method are not explicitly mentioned within the method to design and implement EPM. To do project management, for example methodologies in the likes of Prince2 [Bra02] can be used. These too exist of several activities to be performed when executing a project.

5.3.5 **Roles & responsibilities**

A summary of the roles and responsibilities derived from the analysis of current practices are already given in paragraph 4.3.3. Herein it became clear that a project to design and implement EPM has the following roles:

- Initiator
- Coach
- Project leader / program manager
- Strategy group
- Project team
- Organizational facilitator
- Feedback group/works council
- Steering committee
- Champion
- Builder
- End user
- Trainer

Within the activity 'set initial roles & responsibilities' responsibilities to each of these roles are appointed and persons are appointed to each of the roles. To be sure the right persons are in place, team skills are assessed. At the end of the planning stage, thus when the EPM strategy is created and the actual design is started, the definite roles and responsibilities must be determined. The precise

roles and responsibilities differ per EPM project whereas these differ in size and impact. For example when the project has a big impact on the way people work in the company, they must be incorporated in the steering committee. To set the roles and responsibilities, a RASCI table can be used. This is a table to assign responsibilities to roles by indicating per role if the person is Responsible, Accountable, give Support, Consulted or Informed.

5.4   Conclusion and discussion of solution design

This chapter gives a conclusion and discussion per part of the solution design. The solution will be evaluated in the next chapter (chapter 6).

5.4.1   Enterprise performance system model

The chapter began with the proposition of an enterprise performance system model, derived from current practices. The model shows properties of an EPM solution in practice, thus (partly) answering the third research question 'What are the properties of an EPM solution in practice?'. In reference to the developed method, the EPM system model is part of the system design as depicted by step 5.4: `design IT solution`.

5.4.2   Factors influencing the method

The critical success factors and the EPM view derived from both current practices and a literature review provided input for the construction of the method itself.

Critical success factors

The determined critical success factors (CSFs) for EPM had several implications for the method to design and implement EPM. The exact results of these implications were summarized within `Appendix F: Traceability matrices`. Herein it was made clear that the CSFs especially influence the design of the `supporting activities`. Although these `supporting activities` are used in several types of projects, one should pay extra attention to the ones derived from the CSFs as these are especially important when introducing EPM.

EPM view

Within the `EPM view` it was shown that different views on EPM require different ways in which an EPM project is conducted. To support this, several implications were given for the method. Mainly the distinction between the (re)design of organizational processes and the design of the EPM system itself was a direct result of the `EPM view`. Therefore the use of the conceptual framework from paragraph 2.3 appeared to be adequate to help designing the solution.

5.4.3   EPM method

The EPM method provided an answer to the main research question '*What can be a method towards the design and implementation of an enterprise performance management solution, and what are the properties of this solution?'.* The structuring of this method was done according to the conceptual framework as proposed in paragraph 2.3. This framework appeared to be sufficient to build the method around. The developed method consists of phases, steps, supporting activities, and methods and techniques. This means that within the method the element `activities` of the conceptual framework is split into `steps` and `supporting activities`.

Phases & steps

Several phases and steps were derived from literature and current practices. Hereby the PDCA cycle was used to structure the method. The execution of some of the derived steps is dependent on the chosen EPM strategy, i.e. not all steps have to be carried out in small EPM projects.

Supporting activities

The `supporting activities` are those activities which are not executed in a specific order or at a certain phase in the project. These activities were especially mentioned during the interviews and are partly derived from the critical success factors of EPM projects. The `supporting activities` add value to the model, whereas these show what one needs to carry out in order to successfully design and implement EPM.

Within each focus area of the 'supporting activities', activities on specific literature and current practices for this area can be added to the model. This includes for example literature about project management, like Prince2. Prince2 entails the execution of several activities and steps, which can be added to the `supporting activity` focus area 'project & program management'. These kinds of additions improve the completeness of the EPM method and make the method more pragmatic.

Methods & techniques

Methods and techniques were added to the model to give practitioners some guidance when designing and implementing EPM. The developed list of methods and techniques is not a complete list, but it does give a picture of what can be used during each phase of EPM design and implementation. Also, the techniques and methods to be used are dependent on the chosen EPM strategy and thus the EPM maturity level of the organization.

Roles & responsibilities

Roles and responsibilities were not included in the method whereas these differ per EPM project and are dependent on the chosen EPM strategy. Herein the size and impact of the EPM project, combined with the organizational culture is of influence on the precise roles and responsibilities to be allocated.

6 Evaluation

This chapter consists of two parts. The first part deals with the evaluation of the solution design as proposed within the previous chapter. The goal of this evaluation is to test the solution and to get feedback to improve the designed solution. Via a workshop at Fundeon feedback is retrieved and digested to come to a renewed method for the design and implementation of EPM. Because the initial request to research EPM came from Fundeon, the workshop also took place at their office. To increase feedback and improve the quality of the workshop, also persons from IT-Eye participated.

Within this first part (paragraph 6.1) the complete methodology of the evaluation of the method is described (paragraph 6.1.1). Thereafter the results of the workshop are provided (paragraph 6.1.2) followed by the proposed changes to the method (paragraph 6.1.3). Also a discussion of these results is given (paragraph 6.1.4).

The second part of this chapter (paragraph 6.2) deals with the evaluation of the research process. With the help of the seven guidelines of Hevner et al. [HMPR04], the completeness of the research design is tested. The result of this evaluation should increase the validity of the proposed solution design.

The chapter ends with a conclusion of the evaluation (paragraph 6.3). Herein it is made clear what the limitations of the evaluation were and what can be said about the validity of the proposed solution.

6.1 Evaluation of the solution design

6.1.1 Methodology to evaluate the solution design

To evaluate the solution design, an interactive workshop was held at Fundeon. Unfortunately, the initial idea of involving people from each management layer and conduct a small scale simulation of the usage of the method in practice appeared to be unfeasible. As an alternative, an interactive workshop was arranged with a relatively small number of participants. The participants of this workshop included four persons: a business analyst and principal consultant of IT-Eye, and from Fundeon the CIO and the market information manager (responsible for the formulation of Fundeon`s policy and mid-term strategy).

The main goal from the researcher`s perspective was to get direct feedback on the solution design from different perspectives. In this way, the applicability and completeness of the method was evaluated. From a practical perspective, the workshop was intended to provide some useful ideas for Fundeon itself to get their cooperation.

The workshop was intended to provide at least answers to the following questions:

1) Can the participants come up with additional critical success factors one must cope with when conducting an EPM project?
2) Do the participants believe the developed method could be useful in practice?
3) What changes can be made to the developed method?
4) What methods & techniques can be added to the solution design?
5) How should the EPM project team look like and what is the role of the end users?

As shown in Appendix H: Workshop slides, diverse methods were used to answer these questions. The main part of the workshop consisted of direct feedback on the phases, steps and activities of the method. It must be noted that due to time constraints it was not possible to evaluate the recovered methods & techniques within the workshop.

The design of the workshop consisted of several parts:

❖ Introduction
  The participants are introduced to the subject of enterprise performance management. This is done by first making a mind map of current associations with EPM, and then an explanation of the term as it is used in this research. Also an explanation is given on the EPM system model created within this research to give understanding on how EPM can look like in practice.
❖ Critical success factors
  The participants are asked to write down five factors which they believe are critical to the success of an EPM project. The results provide insight in the experiences of the participants in similar projects.
❖ Discussion of the method
  The main part of the workshop consists of the evaluation of the method to design and implement EPM. To do so, first the phases of the method are discussed, where after the steps within these phases and the `supporting activities` are dealt with. In other words, first the method is discussed on a high level followed by a more precise discussion per phase.

❖ Methods & techniques
Because of time constraints it was not possible to evaluate the recovered methods & techniques within the workshop.

❖ Roles and responsibilities
Herein the participants are given direct questions to gain information about the expected use of roles and their responsibilities within an EPM project.

6.1.2 Workshop results

Within this paragraph the results of the critical success factors, method, and roles and responsibilities are summarized. As mentioned before, the methods and techniques were not evaluated. Also the introduction of the workshop did not provide new insights, and is thus not included in the workshop results.

6.1.2.1 *Results critical success factors*

Table 14 shows the critical success factors (CSF) of EPM as mentioned by the participants during the workshop. As shown, these can all be arranged underneath the developed critical success factors of the solution design. This suggests that the outcomes did not influence the solution design.

Table 14 - Workshop results: critical success factors

	champion	management of resistance	management support	sufficient resources	team skills	user support	effective communication	clear link to business strategy	data management infrastructure	development methodology
certainty in definitions of data									✓	
valid data									✓	
unambiguous criteria/definitions (of data)									✓	
have integrated data									✓	
information must be available for everyone							✓			
support	✓									
management commitment			✓							
organization must be ready on certain points										✓
communication of purpose and necessity							✓			

follow up from information		✓
clear KPI (SMART)	✓	
clear objectives	✓	
make subjective objectives measureable	✓	
link objectives & measurements	✓	
pragmatic (core objectives)	✓	
have one vision of the strategy	✓	
clear mission and vision	✓	
unambiguous business vision	✓	
clear vision & strategy	✓	
flexible solution, it must move with the organization		✓

6.1.2.2 *Results discussion of method*

Within the workshop amongst others the next suggestions and remarks were given:

- Change 'develop initial project vision' in 'develop business case'.
- Do not include 'design business processes' because it will lead to extra resistance. Do mention something like "analyze business processes and organizational structure" within the EPM method, and execute changes in business processes and the organizational structure in parallel or successive projects.
- Split the step 'IT design` in 'design the new (EPM) system' and 'change current data management infrastructure'. The current step is too confusing.
- Remove the step 'design organizational structure', because people will give extra resistance when the organizational structure is changed together with the introduction of EPM.
- Split the step 'implementation plan' into the implementation of EPM and the adjustments of current structures.
- Within the EPM maturity model:
  - Mention the required organization structure per maturity level
  - Tell what is expected per level/list the key success factors per maturity level
  - Make a checklist per level
  - Mention the roles & responsibilities per level
- The supporting activities appear to be generic and should therefore not be the main focus of the method.
- *"The main added value of the methodology is the framework as a whole and the 'methods & techniques' and 'best practices' per phase."*
- *"The framework can be made into a more pragmatic method."*
- *"You captured a lot of criteria".*

As a result of this feedback, changes were made to the method. The renewed method is shown in Appendix I: Renewed method towards the design and implementation of an enterprise performance

management solution. The next paragraphs summarize the applied changes as a result of the workshop. In addition, step 1.1 'develop initial project vision' is changed into 'develop business case'. This should improve the understanding of the contents of this step.

6.1.2.3 Results roles and responsibilities

Within the workshop, several questions were asked regarding roles and responsibilities. The questions and the participants' answers are listed below.

- What is the role of the director?
  The general director and the complete direction team must have full support for the EPM project. They must have a strategic vision, i.e. they must be the visionaries. This is a precondition for the success of EPM.
- Who should be included in the project team?
  There must be several teams for each different area. For example there must be a project team dealing with business process improvement and a team which implements the software of the system. All these teams must be directed by one body, for example an EPM board. This body is responsible for the directions of the entire project and its content. Whereas each part requires different knowledge, this board should consist of people from different expertise areas. The body can also be the champion of the project.
- Who should be the project leader?
  If the structure is right, it does not matter that much who is the project leader. It must be the person best qualified to do so. Sometimes the choice of the project leader is dependent on the culture of the organization.
- In which phases does one involve the end user?
  Within all phases the end user should be involved, although this is dependent on the problem addressed within the project.

Because the answers to the questions do not have contradictions with the solution design, no changes have to be made as a result of this part of the evaluation. The provided answers do support the statement that a steering committee should be appointed. Also the need for a visionary was mentioned, which can be compared with the need for a champion as defined in the list of critical success factors. In this same list also the critical success factor 'management support' was supported.

6.1.3   *Changes to the method*

The participants of the workshop proposed several adaptations of the method. As a result of these propositions, this paragraph summarizes the required changes per phase in which they occur.

6.1.3.1   *Phase 4: Develop EPM strategy*

The participants of the workshop noted that 'design business processes' and `change organizational structure` makes it more difficult to get support for the EPM project, and should therefore not be explicitly mentioned within the method. However, it was noted that these activities probably are required and/or preferred when conducting an EPM project. To underline this statement, step 4.5 is added to the model: `start subsidiary projects`. This entails the initiation of parallel projects like business process re-engineering and organizational restructuring. When designing and implementing the EPM solution, one needs to deal with these parallel projects. The renewed version of phase four is visualized in Figure 36.

6.1.3.2   *Phase 5: Design system*

As a result of the workshop, it is suggested that the former steps 5.1 and 5.2 are deleted. The execution of the steps can now be seen as an integral part of step 5.2a: 'design EPM system'. Herein one has to deal with the subsidiary projects as started in step 4.5. The former step 'design IT solution' is split into step 5.2a: 'design EPM system' and 5.2b: 'redesign data management infrastructure'. This is done to take away the confusion of the participants they had with the contents of this step. The renewed phase is shown in Figure 37.

6.1.3.3   *Phase 6: Implement*

Following the changes of phase 5, phase 6 also underwent some changes to take away some confusion. This led to the transformation of former steps 6.2a 'implement IT system' and 2.6b 'change organizational structure' into 'implement EPM system' and 'change data management infrastructure' respectively. Also former step 6.1 is changed from 'develop implementation plan' into 'develop implementation plans'. By using this plural form, it is indicated that an implementation plan must be made for both the new EPM system and the reengineering of the data management infrastructure. Figure 37 shows the renewed version of this phase.
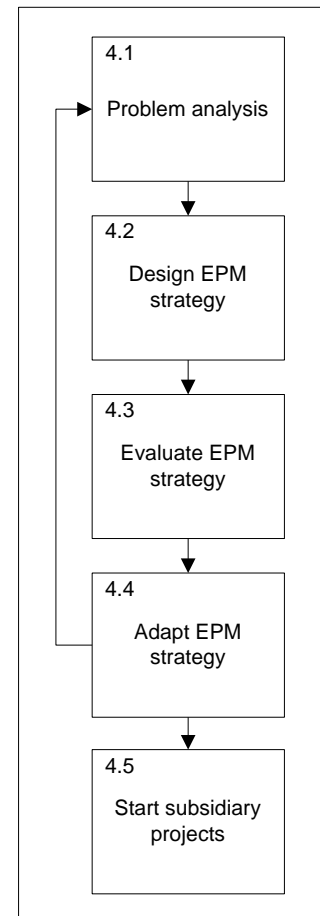
Figure 36 - Renewed phase 4
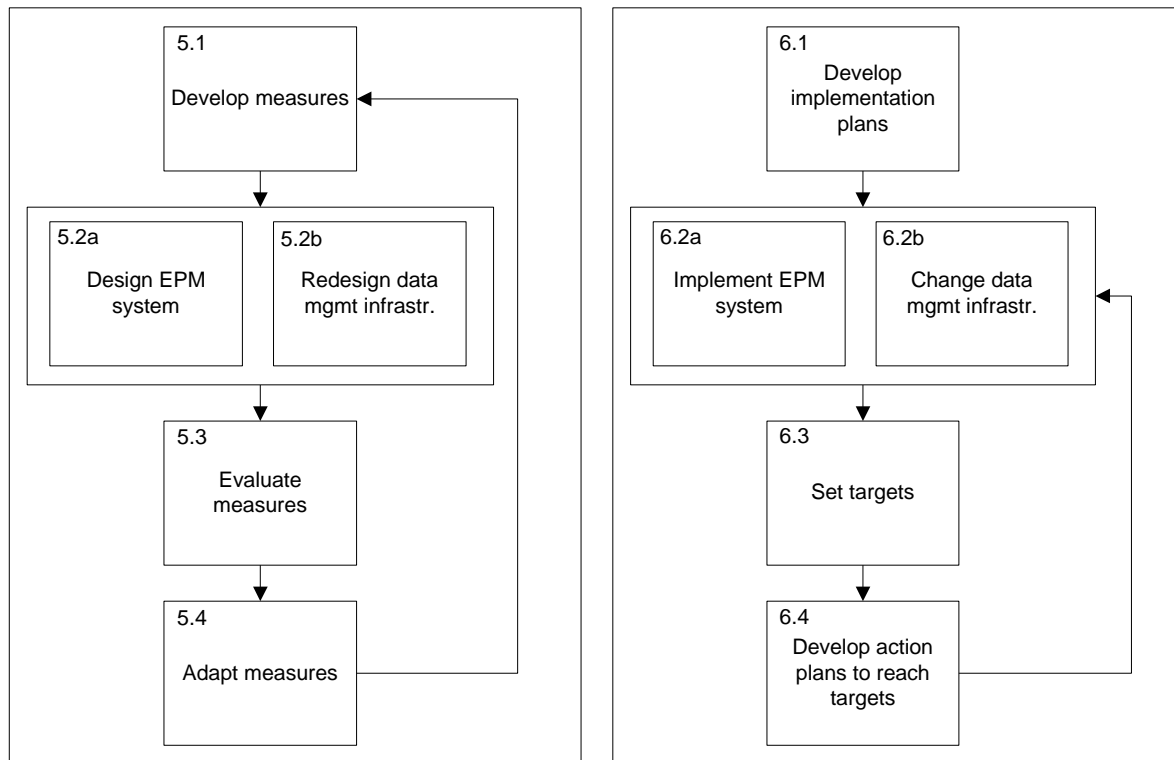
Figure 37 - Renewed phases 5 (left model) and 6 (right model)

6.1.4 Discussion workshop results

The first question was stated as '*Can the participants come up with additional critical success factors one must cope with when conducting an EPM project?*'. The outcomes of the workshop did result in a list of critical success factors (CSFs), but these can all be arranged under the predefined CFSs (see paragraph 5.2.1). The factors the participants came up were written independently of each other, but appeared to have a lot of overlap. Especially the CSFs 'data management infrastructure' and 'clear link with the business strategy' were mentioned.

The second question was stated as '*Do the participants believe the developed method could be useful in practice?*'. The participants did give some clues about how the method can be useful in practice. Although the method can be made more pragmatic, it was noted that it can provide guidance when designing and implementing EPM. Especially the methods & techniques, and best practices can make the method a useful instrument. An elaboration of the EPM maturity model should be very useful, especially when it contains checklists showing the exact actions to execute.

The third question, '*What changes can be made to the developed method?*', led to several modifications of the method. Amongst others, it was proposed to split the step 'IT design` in 'design the new (EPM) system' and 'change current data management infrastructure'. The renewed EPM method should reduce resistance for the project and be less confusing than the previously proposed solution design.

As mentioned before, the fourth question '*What methods & techniques can be added to the solution design?*' unfortunately could not be answered during the workshop. Further research must be carried out to evaluate the recovered methods and techniques.

The fifth question, *'How should the EPM project team look like and what is the role of the end users?'* was dealt with by posing several questions to the participants. It was made clear that the answer to this question depends on the business case. It was noted that the teams must be directed by one body, e.g. an EPM board. This is similar to the solution design where the suggestion is made to appoint a steering committee.

The workshop also appeared to be useful for Fundeon. Some ideas were attained and put to action. For example a start is made to develop an own KPI tree (see paragraph 5.3.4.5.5). This should improve their insights in their current performance.

6.2 Evaluation of the research process

The validation of the method to design and implement EPM is done with the help of the design-science research guidelines of Hevner et al. [HMPR04]. They state that "*the purpose for establishing these seven guidelines is to assist researchers, reviewers, editors, and readers to understand the requirements for effective design science research.*" Hereby each of the guidelines must be addressed in some way for the design-science to be complete. Within the next paragraphs the solution design is discussed for each of the seven guidelines. The guidelines are summarized in Table 15.

Table 15 - Design-Science Research Guidelines [HMPR04]

Guideline 1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
Guideline 5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

6.2.1 Guideline 1: Design as an artifact

Hevner at al. [HMPR04] state that design-science research must produce a viable artifact. Within this research this consists of a proposition for a method to design and implement EPM. This research also provides a conceptual framework which helps designing an approach for EPM. Both are viable: the method can be used in practice and the framework can be used to design similar approaches.

6.2.2   Guideline 2: Problem relevance

As chapter 1 showed, this research provides a solution for important and relevant business problems by developing a method to help the process of EPM design and implementation. When one has completed the execution of the method, the company has implemented an EPM solution. Part of this solution is a technical implementation in the form of an EPM system. This research provided a model of such a system.

6.2.3   Guideline 3: Design evaluation

Hevner at al. [HMPR04] mention five methods to evaluate a design, i.e. observational, analytical, experimental, testing and descriptive evaluation. As previous mentioned within this chapter, this research` solution design was tested via a controlled experiment by conducting a workshop at Fundeon. However, it must be noted that the size of this workshop was limited. To truly evaluate the design in a rigorously way, the method must be tested by putting it at least a couple of times in practice. This implies that several case studies are required to improve the justification of the solution. In other words, more research is required to evaluate the method.

6.2.4   Guideline 4: Research contributions

As stated in chapter 1, the present EPM frameworks are little specific for EPM development and are less practical in supporting the design and implementation of EPM solutions. The designed solution tried to fill this gap by suggesting a method for the design and implementation.

Next to this, a system model of EPM was proposed by analyzing literature and current practices. A framework was developed to help designing and structuring an EPM approach. Adaptations of this framework can be used to design approaches in general.

6.2.5   Guideline 5: Research rigor

According to Hevner at al. [HMPR04] "*rigor addresses the way in which research is conducted. Design-science research requires the application of rigorous methods in both the construction and evaluation of the designed artifact.*" Furthermore, they state that "*in both design-science and behavioral-science research, rigor is derived from the effective use of the knowledge base - theoretical foundations and research methodologies. Success is predicated on the researcher's skilled selection of appropriate techniques to develop or construct a theory or artifact and the selection of appropriate means to justify the theory or evaluate the artifact.*"

The basis of the developed solution design lies at a literature review and an analysis of current practices. It is believed that the literature review provides a sufficient knowledge base (the theoretical foundation) for the designed solution. With the help of the proposed framework for the EPM approach, we state that the recovered literature was structured in an effective way to help developing a method to design and implement EPM.

Almost certainly the inclusion of more cases, i.e. conducting more expert interviews, provides more useful information for the analysis of current practices. This can result in additions to the developed solution design. Nevertheless, the analysis of current practices as it is done within this research did provide sufficient information to be able to build the method. Therefore it is believed that this research conforms to this guideline.

6.2.6   Guideline 6: Design as a search process

Hevner at al. [HMPR04] state that design science is an iterative process, whereby "*heuristic search strategies produce feasible, good designs that can be implemented in the business environment*".

With the help of a conceptual framework a search in both literature and current practices was started to get the right information needed for the solution design. Interviews were held and a workshop was organized. The literature search on itself was also an iterative process, using the approaches of Webster and Watson [WW02] and Levy and Ellis [LE06] (see paragraph 2.4). Therefore it is claimed that this research made use of a heuristic search strategy, thereby conforming to the sixth guideline.

6.2.6.1   *Guideline 7: Communication of research*

The intention of this thesis is to present the research in an effective way for technology-oriented as well as management-oriented audiences. The latter is extra assisted by the inclusion of a management summary. Chapters 3, 4 and 5 are structured according to the defined framework of chapter 2.3 to make the recovering of relevant information easier. An overview of the developed method is made which fits one page (see Appendix I: Renewed method towards the design and implementation of an enterprise performance management solution). With this overview the results of this research are quickly communicated to the audience. Therefore it is claimed that this research also follows the last guideline.

6.3 Conclusion of evaluation

Although the initial plans to evaluate the method appeared to be unfeasible, the alternative form of evaluation provided useful feedback. The choice was made to use a workshop form to evaluate the method with practitioners. These practitioners were critical on the method, and provided sufficient feedback.

The participants mentioned critical success factors, and answers to questions about roles and responsibilities were given. The outcomes did not contradict the solution design, thus supporting its validity. It must be noted that some of this feedback was used for the extended description of parts of the solution design.

Another part of the workshop consisted of feedback on the method itself. This resulted in several changes to the solution design, i.e. adaptations were proposed for phases four, five and six of the method. These changes are primarily included to take away resistance to the project, and to emphasize on the difference of designing and implementing the new (EPM) system and the altering of the current data management infrastructure to support this new system.

The participants noted that the method can be made more pragmatic, and also that it can provide guidance when designing and implementing EPM. The applicability of the method should be improved by including more `best practices` and by elaborating on the EPM maturity model.

Next to the evaluation of the solution design, the research process was evaluated. This was done with the help of the seven guidelines of Hevner et al. [HMPR04]. It was shown that these guidelines were followed, although the evaluation of the design should be extended. This evaluation of the research process has given more support for the validity of the designed solution.

Because design science is an iterative process [HMPR04], conducting more workshops should further more improve the solution design. Also the election of participants should be extended by incorporating persons from different types of organizations and management layers.

Further improvements can be made by putting the method in action and extending the method with more (detailed) activities and steps. Therefore no claims can be made on the current validity of the proposed solution.

7 Conclusions

This final chapter consists of three parts. It summarizes the conducted research, shows the answer to the main research question and gives suggestions for further research.

7.1 Summary

Within this thesis a method is suggested to come to an enterprise performance management (EPM) solution. This method provides companies guidance when applying EPM to improve the alignment of business processes with the business strategy and to enhance the ability of measuring performance. A conceptual framework has been introduced to structure the desired method. Several elements are added to this framework to indicate what factors influence the method. Another element is added to represent the EPM system model, thus illustrating how the solution can look like when the method has been applied in practice.

To fill in the elements of the framework, first a review was done on the current state of affairs in literature regarding EPM. To gain mutual understanding on its term, the next definition of EPM was introduced:

Enterprise performance management is the use of quantified information about the efficiency and effectiveness of action to effectively monitor, control, and manage the implementation of strategic initiatives, combining the business strategy and technological structure to direct the entire organization towards accomplishing common organizational objectives.

Within the literature research several EPM frameworks were recovered, which all differed in implementation level and context. No all-encompassing methodological approach for EPM design and implementation was found. The literature review did provide an analysis of the phases, steps and activities of performance measurement systems and EPM system design and implementation frameworks. These results were used as the basis for the EPM method. Next to this, factors influencing the method were recovered by summarizing critical success factors and looking at different views on EPM. The developed conceptual framework appeared to be sufficient to structure the literature review and to retrieve the required knowledge to build the method to design and implement EPM (EPM method in short).

The second part of the research consisted of an analysis of current practices. This analysis was done by interviewing several experts and by examining system models from leading software vendors. The latter provided insights in the properties an EPM implementation has in practice. The analysis showed that different experts in the field have different views on EPM, implying that more than one sort of EPM solution exists having different properties. The analysis of current practices provided evidence about the validity of the list of constraints developed within the literature review. The interviews resulted in the designation of eight phases used to conduct an EPM project. Because this research focuses on the design and implementation of EPM, only the six relevant phases were used to build the EPM method. Within the analysis of current practices also steps and activities were derived, and methods and techniques were recovered. Again the conceptual framework appeared to be sufficient to structure the findings.

The third part of the research dealt with the actual solution design. The evidence from both the literature review and the analysis of current practices were combined to propose a solution. The designed solution consists of three parts: the EPM system model, the factors influencing the method

and the method itself. Both the critical success factors and the view on EPM had influence on the designed method, thus again supporting the developed conceptual framework. The element `activities` of the conceptual framework was split into `steps` and `supporting activities`. These `supporting activities` help to execute the proposed steps, and underline the importance of performing activities to deal with the critical success factors. The execution of some of the derived steps is dependent on the chosen EPM strategy, i.e. not all steps have to be carried out in small EPM projects. This developed EPM strategy also influences the roles and responsibilities, and the methods and techniques to be used within an EPM project.

The solution design was evaluated by conducting a workshop. Several changes to the method were suggested, resulting in a renewed version of the EPM method. Because the evaluation had several limitations (it was small-scale and conducted within a specific branch), no claims can be made about the validity of the designed method. The research process by itself was also evaluated by using the seven guidelines of Hevner et al. It was shown that the conducted research conforms to these guidelines. However, it also became clear that the validation and evaluation of the model must be extended.

7.2 Answer to the main research question

The main research question was formulated as:

What can be a method towards the design and implementation of an enterprise performance management solution, and what are the properties of this solution?

This thesis did propose such a method consisting of phases, steps, activities supporting these steps, and methods and techniques to be used. The development of this method is an iterative process, and therefore no claims can be made that this method is holistic or an all-encompassing methodological approach for EPM design and implementation. What can be claimed is that it provides some guidance to help companies approach EPM. Therefore it contributes to the solution of the problem statement, which was defined as:

Companies lack guidance when applying enterprise performance management to improve the alignment of business processes with the business strategy and to enhance the ability of measuring performance.

The second part of the main research question is about the properties of the solution. An answer to this is given by incorporating an EPM system model, and by providing a list of EPM functions found in literature. The combination of these two gives insight in what is realized when implementing EPM.

To help answering the main research question, several sub-questions were defined. The proposed conceptual framework made sure all of these questions were answered by incorporating these as separate elements (except the current state of affairs in literature, as this is covered in a separate chapter). Within the solution design all the elements of the framework were covered, implying that all sub-questions of the research were also covered.

7.3 Further research

Within this research a method has been developed to design and implement EPM. The use of an EPM maturity model was mentioned to help analyze a company`s current state of EPM implementation and to serve as a roadmap. This roadmap gives directions in which a company can improve itself with regard to EPM. Although some suggestions were made about the contents of this model, the actual development of such a model was outside the scope of this research. Therefore the development of an EPM maturity model is suggested for further research.

The EPM maturity model must have several levels to determine the current EPM maturity of a company. This requires that per level the methods and techniques, and the roles and responsibilities must be established by conducting additional research. The result of this research can require changes to the steps and activities of the developed EPM method.

Further research also consists of the inclusion of deliverables per step and/or phase of the method. This should help to clarify what is expected within each of the steps, to improve the planning of the project and to set milestones. The inclusion of precise inputs and outputs per step is not encouraged, whereas this limits the freedom of the project team. Hereby one must recall that one of the critical success factors of EPM is the use of an evolutionary methodology, implying that the methodology must be iterative and not too static.

As mentioned before, within this research a conceptual framework has been proposed to help building the method. It appeared to be quite useful to structure the solution design. It should be interesting to know if (an adaptation of) this framework is also of use when developing similar methods.

This research was limited by available resources and time constraints. Therefore several improvements of the methods can be made by conducting additional research. The analysis of current practices can be improved by involving more field experts. Multiple case studies can be executed to get insight in how current companies have approached the design and implementation of EPM. The evaluation of the solution design can be improved by conducting more workshops. These workshops should have participants from different types of organizations and management layers. The validation of the solution design can be researched by applying the method in practice, for example by introducing EPM at Fundeon.

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Appendices

Appendix A: Interview questions

Background

1. What is your job role?
2. How long have you been doing this job?
3. When did you start applying EPM?
4. On how many EPM or PMS projects have you been working?
5. Which type of business did you apply EPM the most?

Methodology

6. How would you describe EPM?
7. Do you make use of a standard method to approach an EPM project?
8. Do you introduce EPM in phases?
   a. If so, which phases do you use?
   b. Do you think this is effective?
9. Can you suggest which activities are to be deployed when designing and implementing an EPM solution?
10. Do you make use of a performance measurement framework like the Balanced scorecard or the EFQM model?
11. Which methods and techniques do you use when applying EPM?

Approach

12. Which persons do you include when designing and implementing an EPM project?
13. Can you think of any other persons involved in an EPM project?
14. What are the responsibilities of each of these persons?
15. How would you construct the project team?
16. Which person is usually the initiator of the project?
17. Does your approach differ when dealing with smaller companies?
18. Does the organization within the company influence the introduction of EPM?

Success factors

19. What do you think are the success factors of an EPM project?
20. Which precautions do you take to increase the likelihood of success?

System

21. In your opinion, what are the main elements of an EPM system?
22. Do you make use of a standard software package to form the basis of an EPM system?
23. How does the ideal EPM system look like?

Appendix B: Node list to structure interviews results

- Background

  This entails the background information of the respondents to see if the outcomes differ when the respondent focuses on different markets segments and/or has different EPM experience. A summary of the background of the respondents is given in Appendix C: Additional interview data.

- Definition

  A definition node is incorporated to make sure the interviewer and the respondents have the same understanding of the term EPM. A summary of the expert`s definition of EPM is elaborated in Appendix C: Additional interview data.

- EPM view

  This node gives information about the respondent`s view on EPM. This includes statements about how the company should be steered and how EPM should support this managing method. This node also involves statements about the way EPM should be scoped.

- CSF

  The critical success factors (CSF`s) of the EPM system and how these influence the way EPM is approached.

- Phases

  The phases of EPM, including sub phases to develop key performance indicators (KPI`s).

- Activities

  These are the high-level activities which are performed when conducting EPM, such as project management and change management. It has activities executed in a specific order (steps), activities executed within specific phases, and activities executed during multiple phases (supporting activities).

- Roles & responsibilities

  This node summarizes the (group of) persons to be involved in an EPM project. Also includes the responsibilities of these persons for different activities within EPM.

- Methods & techniques

  The methods and techniques used to conduct EPM, executed within different phases of EPM.

- EPM System

  Summarizes how the system should look like in terms of elements and layers, and possible software packages to support these elements.

- Future of EPM

  This node is incorporated to understand how EPM will look like in the future, providing some insights in what the respondents see as the ideal EPM solution. A summary of the outcomes is provided in Appendix C: Additional interview data.

Appendix C: Additional interview data

Background

Within the next tables the background information of the respondents are summarized. A distinction has been made between companies having less than hundred employees and companies with over hundred employees. The summaries are based upon the answers from the interviews with the respondents.

Respondent 1	
Job title	Director
Job description	EPM consultancy
Company size	<100
Company description	Small specialized EPM consultancy company for over 15 years
EPM client base	Small and large clients, independent of branch. 40-50 clients from which 15-20 are guided for the duration of the complete EPM project, with a time span of over a year

Respondent 2	
Job title	Director
Job description	-
Company size	<100
Company description	Provides advice and implementation services, specialized in the domains ranging from strategic finance and strategic planning towards operational planning, financial consolidation
EPM client base	Large international organizations which are quoted on the stock exchange

Respondent 3	
Job title	Partner
Job description	Expert on management inquiries, consultancy for EPM, BI, data warehouses, ETL and decision support.
Company size	>100
Company description	Large international firm in consultancy, ICT and outsourcing
EPM client base	Mainly focused on large organizations in the finance & public sector

Respondent 4	
Job title	Senior organization advisor
Job description	Specialized in management information
Company size	>100
Company description	Large international IT-service provider
EPM client base	Respondent has done 2 implementations at the private sector and 5 at the public sector

Respondent 5	
Job title	Director
Job description	-
Company size	<100
Company description	Service provider. Specialized in performance management, system and network management, system development and maintenance, and output management systems
EPM client base	Implementations at all large Dutch companies and international large companies

Definition EPM

The respondents were asked what they believe EPM incorporates. All agree that several terms exist by which the same thing is meant. A suggestion was made that it has become xPM, where x can stand for anything: strategic, enterprise, corporate, business or integration. EPM is seen as a container definition entailing the processes, methodologies, metrics and systems needed to measure and manage your organizations performance. It is proposed that EPM is originated from a need for management information which was not provided by Enterprise Resource Planning (ERP) systems. With the arrival of better search algorithms and increased processing power, it has become possible to process more data to come to better management information. This provides the technical base to be able to set up a holistic EPM system.

Future of Enterprise Performance Management

The respondents suggest that the new generation software packages on the market will completely integrate all components of EPM with the same look-and-feel. Especially an improvement will be made with regard to functional integration. The respondents expect that performance management information will be linked to document management systems, increasing the context information of performance issues. Search engines like Google make it much easier to analyze big piles of data, making it possible to add this semantic information to performance measures.

Appendix D: Approaches to structural design

Daft [Daf03] suggests five approaches to structural organizational design, as displayed below:
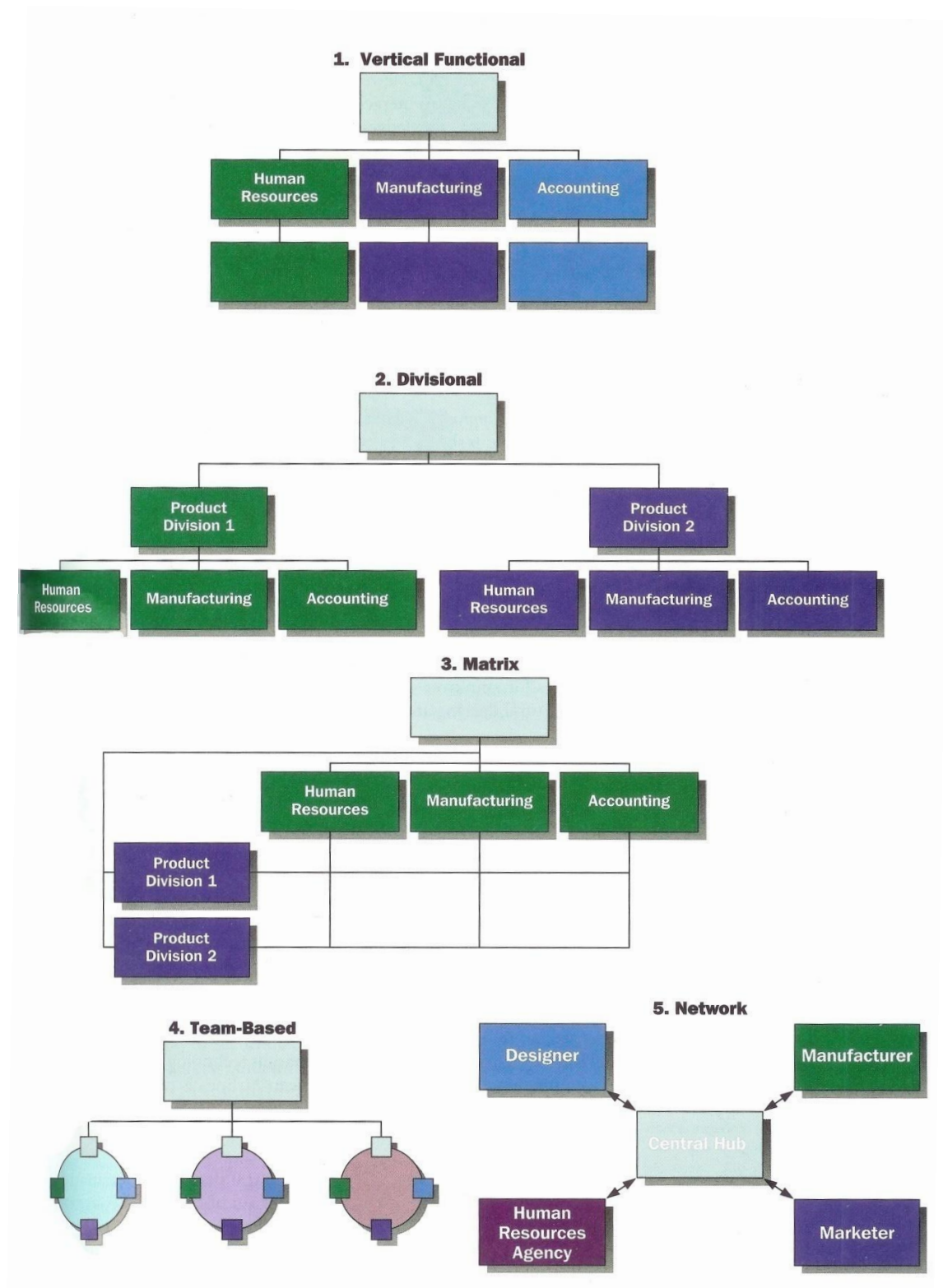
Appendix E: Method towards the design and implementation of an enterprise performance management solution
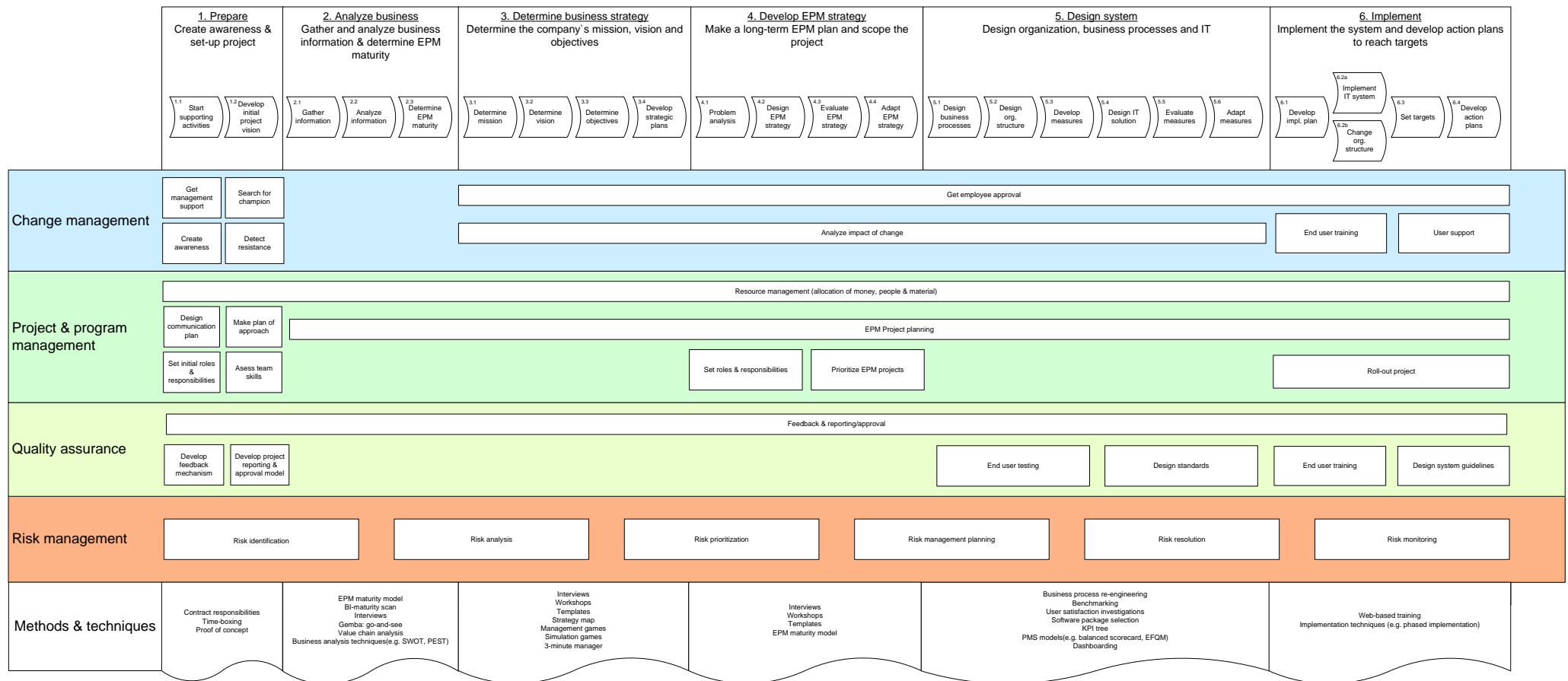
Appendix F: Traceability matrices

This appendix shows the origin of the steps and `supporting activities` of the developed method. It provides the evidence of why these specific activities were included within the solution design.

Traceability steps

The next part shows the origin of the steps of the developed method. Within the columns, the steps of the method are placed. The rows show the evidence for the creation of the steps of the method. The first table shows the comparison of the derived steps and activities from PMS frameworks (see Table 7 from the literature review) and the steps of the solution design. The second table shows a comparison of the phases and steps derived from the expert interviews (see Table 12 from current practices) and the steps of the solution design. Note that not all steps are covered. The inclusion of these steps is explained in the next list:

➢ Determine EPM maturity

The experts noted that they use an EPM maturity model to make an analysis of the current state of EPM implementation of the company. This helps creating a picture of the current state the company is in. To emphasize this, this step was added (see also paragraph 5.3.2.2.3).

➢ Evaluate EPM strategy

To incorporate continuous improvement and to conform to the PDCA cycle, this step was added (see paragraph 5.3.2.4.3 for explanation).

➢ Adapt EPM strategy

As with the previous step, continuous improvement required the addition of this step (see paragraph 5.3.2.4.4 for more detail).

➢ Design organizational structure

The factor 'EPM view' mentions the inclusion of redesign of the organizational structure as part of EPM design. This resulted in the addition of a step to (re)design the structure of the organization (see paragraph 5.3.2.5.2).

➢ Evaluate measures

Equivalent to the additional steps for the EPM strategy, 'evaluate measures' is added to incorporate continuous improvement. Not all measures may be covered with the designed system, or new opportunities may arise. A full explanation is given in paragraph 5.3.2.5.5.

➢ Adapt measures

After the evaluation of the measures, they have to be adjusted. Therefore the addition of this step is required. For more, see paragraph 5.3.2.5.6.

	Start supporting activities	Develop initial project vision	Gather information	Analyze information	Determine EPM maturity	Determine mission	Determine vision	Determine objectives	Develop strategic plans	Problem analysis	Design EPM strategy	Evaluate EPM strategy	Adapt EPM strategy	Design business processes	Design organizational structure	Develop measures	Design IT solution	Evaluate measures	Adapt measures	Develop implementation plan	a: implement IT system; b: change organizational structure	Set targets	Develop action plans to reach targets
project vision		✓																					
determine scope/identify business unit		✓																					
assess environment			✓																				
define mission						✓																	
identify directions/strategy									✓														
identify objectives								✓															
design strategy map									✓														
identify performance drivers																✓							
determine key drivers																✓							
design/collect measures																✓							
group measures																✓							
sort & analyze measures																✓							
determine way of measurement																	✓						
measure owners/roles																				✓			
set targets																						✓	
communicate measures to lower levels[b]																							✓
formulate action plan to reach targets																							✓
formulate implementation plan																				✓			
roll-out[b]																							
re-evaluate/review/revise[a]																							

	Start supporting activities	Develop initial project vision	Gather information	Analyze information	Determine EPM maturity	Determine mission	Determine vision	Determine objectives	Develop strategic plans	Problem analysis	Design EPM strategy	Evaluate EPM strategy	Adapt EPM strategy	Design business processes	Design organizational structure	Develop measures	Design IT solution	Evaluate measures	Adapt measures	Develop implementation plan	a: implement IT system; b: change organizational structure	Set targets	Develop action plans to reach targets
Respondent 1:																							
create awareness to start EPM	✓																						
set project objectives		✓																					
gather (strategy) information			✓																				
gather financial & client objectives			✓																				
analyze work floor processes				✓																			
determine mission						✓																	
determine strategic objectives								✓															
set KPI`s																		✓					
improve processes														✓									
create transparency																							✓

Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14
implement review structure														✓
Respondent 2:														
analyze				✓										
gather management information			✓											
develop strategic plan								✓						
develop EPM strategy										✓				
develop data model													✓	
determine processes											✓			
select software package													✓	
system design													✓	
consolidation														✓
realization														✓
test[b]														
roll-out[b]														
training[b]														
Respondent 3:														
preparation	✓													
analyze				✓										
analyze market position				✓										
develop strategy								✓						
develop EPM strategy										✓				
plan project[b]														
determine CSF`s		✓												
system design													✓	
translate strategy to dashboard												✓		
optimize processes											✓			
implementation														✓
training/ follow-up[a/b]														
Respondent 4:														
diagnose		✓												
problem analysis									✓					
analyze strategic documents				✓										
determine mission					✓									
determine vision						✓								
determine CSF		✓												
set KPI`s												✓		
determine process changes											✓			
technical realization														✓
Respondent 5:														
business analysis				✓										
problem analysis									✓					
information analysis				✓										
set business objectives							✓							
make information plan													✓	
make plan of approach[b]														
develop solution alternatives													✓	
roll-out[b]														
testing[b]														
evaluation[a]														
make adjustments[a]														

[a] These steps are dealt with in the phases 'monitor & analyze' and 'adapt', which lay out of the scope of this research; [b] These activities are dealt with in the 'supporting activities' of the method.

Traceability `supporting activities`

The matrix on the next page shows the origin of the `supporting activities`. As most of the activities are derived from the critical success factors (CSFs; see 5.2.1), these are summarized in the upper part of the table. The last three CSFs are not dealt with in the `supporting activities`, but in the phases of the method. One deals with the CSF 'Clear Link to Business Strategy` amongst others by executing the phase 'determine business strategy`. The phase 'analyze business` deals with the CSF ` State of Existing Data management Infrastructure`. The EPM method as a whole can be seen as the `evolutionary development methodology` to introduce EPM.

As announced in the traceability matrices of the steps, some of the derived steps and activities from PMS frameworks (see Table 7 from the literature review) and phases and steps derived from the expert interviews (see Table 12 from current practices) are dealt with within the `supporting activities`. Therefore these are included within the matrix.

The activities of the `supporting activities` are arranged according to their corresponsive focus areas. Note that the activities of risk management are not included. This is done because this consists of activities directly derived from the software risk management cycle of Boehm [Boe91].

As one can see, all of the activities within the method can be traced back to the defined critical success factors, the literature review and/or the evidence of current practices.

	Change management								Project & program management									Quality assurance							
	Get management support	Create awareness	Search for a champion	Detect resistance	End user training	User support	Get employee approval	Analyze impact of change	Design communication plan	Set initial roles & responsibilities	Make plan of approach	Assess team skills	Set roles & responsibilities	Prioritize EPM projects	Resource management	EPM project planning	Roll-out project	Develop feedback mechanism	Develop project reporting & approval model	Feedback & reporting /approval	End user testing	Design standards	End user training	Design system guidelines	Feedback & reporting/approval
Critical success factors:																									
Champion			✔																						
Management of Resistance		✔		✔	✔		✔	✔		✔			✔												
Management Support	✔																								
Sufficient Resources														✔	✔	✔									
Team Skills										✔		✔	✔												
User Support						✔															✔	✔	✔	✔	
Effective Communication									✔									✔	✔	✔					✔
Clear Link to Business Strategy[a]																									
State of Existing Data management Infrastructure[a]																									
Evolutionary Development Methodology											✔														
Literature review:																									
communicate measures to lower levels									✔																
roll-out																	✔								
Current practices:																									
Respondent 2:																									
test																						✔			
roll-out																	✔								
training																							✔		
Respondent 3:																									
plan project											✔														
training																							✔		
Respondent 5:																									
make plan of approach											✔														
roll-out																	✔								
testing																					✔				

[a] These critical success factors are dealt with in the phases of the method

Appendix G: Maturity Models

Project Maturity Model of Grant and Pennypacker [GP06]
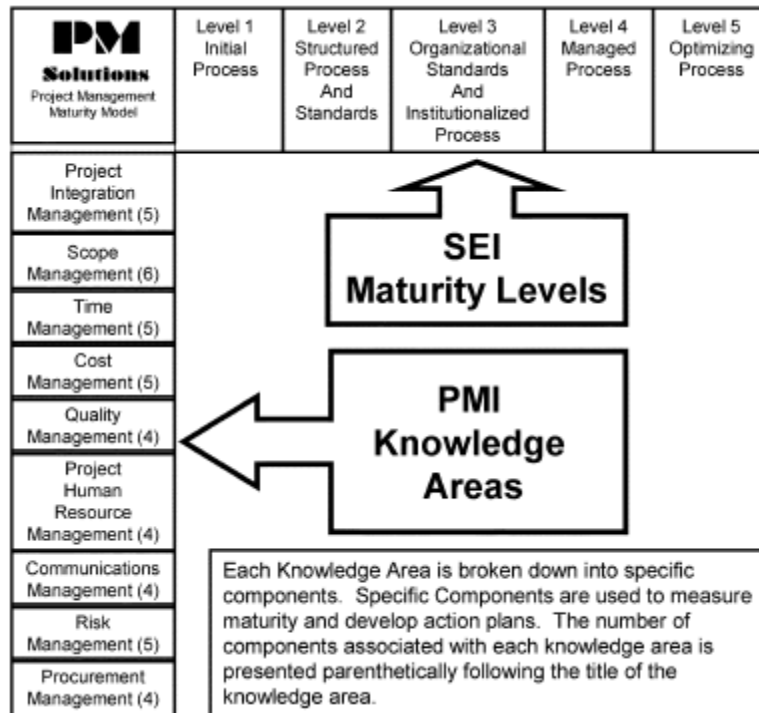
Strategic Planning Model from Gluck et al. [GKW80]

As Ward and Peppard [WP02] denote, the strategic planning model "*describes how the core issues have evolved, along with the need for new approaches to developing and implementing strategies*".
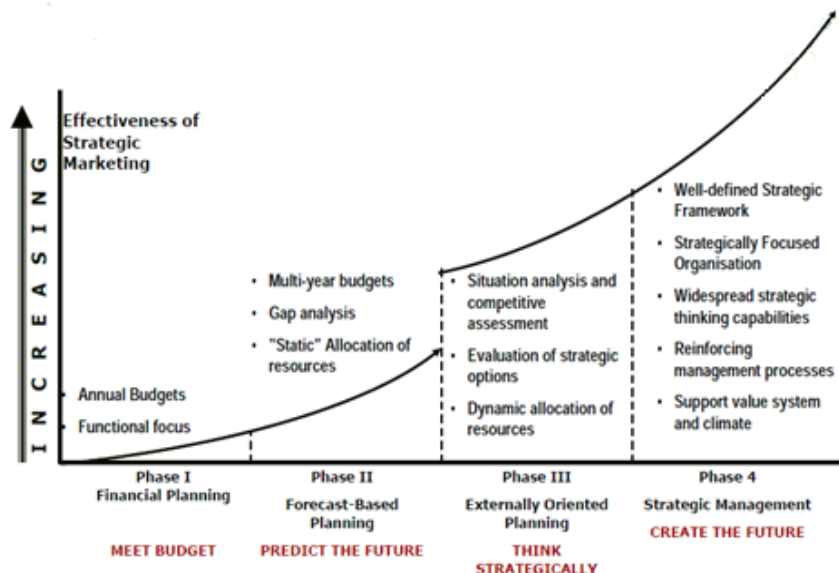
Capability maturity model (CMM)

Fenton and Pfleeger describe CMM as follows:

 "The CMM describes principles and practices that are assumed to lead to better software products, and the model organizes them in five levels, providing a path to more process visibility and control, and to the improved products that result. The model is used in two ways: by potential customers, to identify the strengths and weakness of their suppliers, and by software developers themselves, to assess their capabilities and set a path toward improvement."

The following table describes the key process areas of the CMM [Pau95] (as derived from [FP97])

CMM level	Key process areas
Initial	none
Repeatable	Requirements management
	Software project planning
	Software project tracking and oversight
	Software subcontract management
	Software quality assurance
	Software configuration management
Defined	Organization process focus
	Organization process definition
	Training program
	Integrated software management
	Software product engineering
	Intergroup coordination
	Peer reviews
Managed	Quantitative process management
	Software quality management
Optimizing	Defect prevention
	Technology change management
	Process change management

Appendix H: Workshop slides

Within this appendix the slides of the workshop are given. Because all the participants of the workshop were Dutch, the slides are also written in Dutch. For this overview 21 slides showing per phase the steps & activities to be performed are left out. These slides were used within the workshop to discuss each element.

EPM systeem

View, e.g (webportal)

EPM elements

| Strategy management | Reporting | Analysis | Forecasting | Planning | Budgeting | Financial consolidation |

Integration layer

Data layer
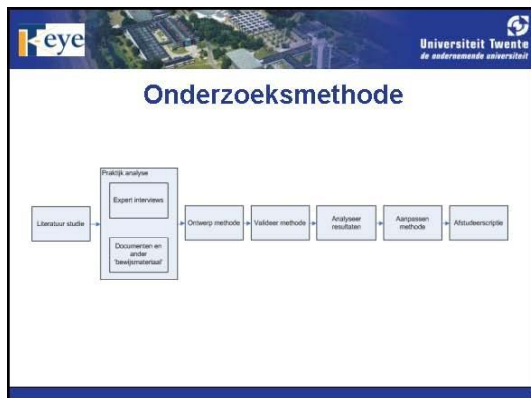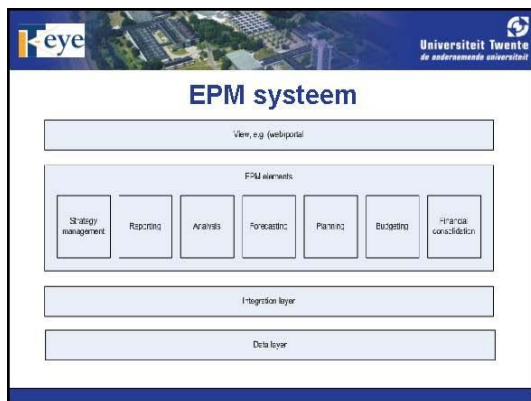
Kritieke succes factoren

- Wat kan er volgens jullie mis gaan bij het invoeren van een EPM project?

De methode
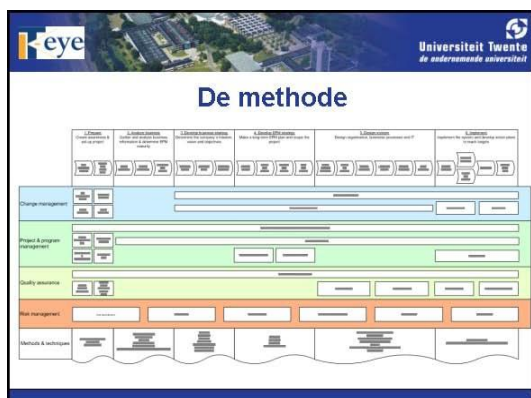
Fasen

1. Voorbereiding
2. Analyse
3. Ontwikkel bedrijfsstrategie
4. Ontwikkel EPM strategie
5. Systeem ontwerp
6. Implementatie

Activiteiten

- Hoofdactiviteiten
- Change Management
- Project & Program Management
- Quality Assurance
- Risk Management

Risk Management

---

21 slides with steps & activities per phase

Algemene feedback methode

De methode

Methoden & technieken

1. Voorbereiding
2. Analyse
3. Ontwikkel bedrijfsstrategie
4. Ontwikkel EPM strategie
5. Systeem ontwerp
6. Implementatie

Rollen & Verantwoordelijkheden

- Wat is de taak van de directeur?
- Wie moeten er in het project team?
- Wie is er projectleider?
- In welke fase(n) de eindgebruiker bij betrekken?

Vragen

Bedankt voor uw input!

Appendix I: Renewed method towards the design and implementation of an enterprise performance management solution

1. Prepare
Create awareness & set-up project

- 1.1 Start supporting activities
- 1.2 Develop business case

2. Analyze business
Gather and analyze business information & determine EPM maturity

- 2.1 Gather information
- 2.2 Analyze information
- 2.3 Determine EPM maturity

3. Determine business strategy
Determine the company`s mission, vision and objectives

- 3.1 Determine mission
- 3.2 Determine vision
- 3.3 Determine objectives
- 3.4 Develop strategic plans

4. Develop EPM strategy
Make a long-term EPM plan and scope the project

- 4.1 Problem analysis
- 4.2 Design EPM strategy
- 4.3 Evaluate EPM strategy
- 4.4 Adapt EPM strategy
- 4.5 Start subsidiary projects

5. Design system
Design organization, business processes and IT

- 5.1 Develop measures
- 5.2a Design EPM system
- 5.2b Redesign data mgmt infrastr.
- 5.3 Evaluate measures
- 5.4 Adapt measures

6. Implement
Implement the system and develop action plans to reach targets

- 6.1 Develop impl. plans
- 6.2a Implement EPM system
- 6.2b Change data mgmt infrastr.
- 6.3 Set targets
- 6.4 Develop action plans

Change management
- Get management support
- Search for champion
- Create awareness
- Detect resistance
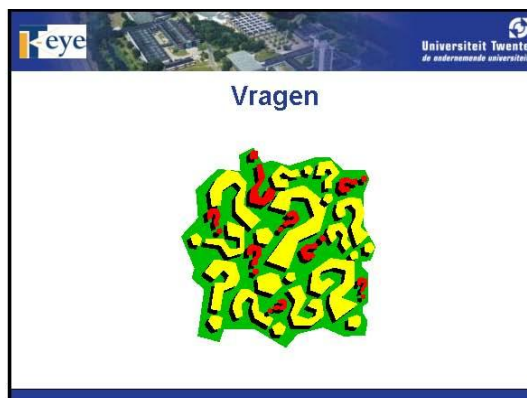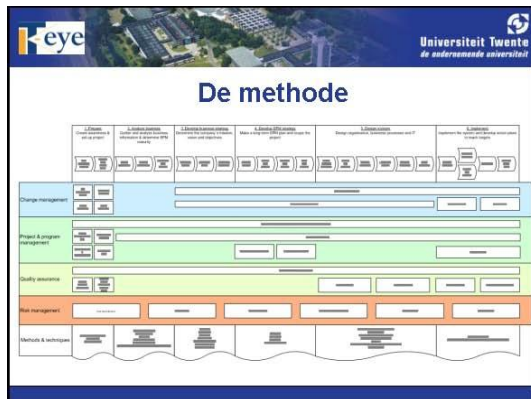- Get employee approval
- Analyze impact of change
- End user training
- User support

Project & program management
- Design communication plan
- Make plan of approach
- Set initial roles & responsibilities
- Asess team skills
- Resource management (allocation of money, people & material)
- EPM Project planning
- Set roles & responsibilities
- Prioritize EPM projects
- Roll-out project

Quality assurance
- Develop feedback mechanism
- Develop project reporting & approval model
- Feedback & reporting/approval
- End user testing
- Design standards
- End user training
- Design system guidelines

Risk management
- Risk identification
- Risk analysis
- Risk prioritization
- Risk management planning
- Risk resolution
- Risk monitoring

Methods & techniques
- Contract responsibilities
  Time-boxing
  Proof of concept
- EPM maturity model
  BI-maturity scan
  Interviews
  Gemba: go-and-see
  Value chain analysis
  Business analysis techniques(e.g. SWOT, PEST)
- Interviews
  Workshops
  Templates
  Strategy map
  Management games
  Simulation games
  3-minute manager
- Interviews
  Workshops
  Templates
  EPM maturity model
- Business process re-engineering
  Benchmarking
  User satisfaction investigations
  Software package selection
  KPI tree
  PMS models(e.g. balanced scorecard, EFQM)
  Dashboarding
- Web-based training
  Implementation techniques (e.g. phased implementation)