Explore the benefits of ERP systems for better Performance Measurement in organizations

Master's thesis Economics & Informatics

Program	Economics & ICT
First Supervisor:	prof. dr. Gert J. van der Pijl RE
Second Supervisor:	drs. Ted P. M. Welten
University:	Erasmus University Rotterdam
Author:	Frank Mink BSc
Student-id:	313092
Date:	3 January 2010

Preface

This thesis represents the results of the research project conducted on the topic of benefits of Enterprise Resource Planning (ERP) systems for Performance Measurement. The project started on the July 1st 2009 and was completed in December 2009. This thesis is the result of a research assignment in order to finalize the Master degree in Economics & ICT. The research was for the main part conducted at Steltix. Steltix is an IT company for Enterprise Resource Planning systems, both consultancy and implementation with a focus on Oracle JD Edwards. Steltix' head office is located in Utrecht, the Netherlands with local offices in several European countries.

This document serves two goals: the first goal is to meet the requirements to graduate as Master of Science in Economics & Informatics at the Erasmus University Rotterdam. The second goal is to assist / help Steltix in the development of the Oracle Business Intelligence Connector which is meant to be a standard solution for Performance Measurement for Oracle JD Edwards users.

This master thesis could not have been realized without the help of Steltix, and especially some employees. I would like to thank Mr. Peter Koorevaar, Mr. Wim Doedens, Mr. Koen Rakers and Mr. Anton Wessels for their constructive comments and for offering me the possibility to visit and interview Steltix' customers and. I also want to thank Prof. Dr. Gert J. van der Pijl for guiding the research in the right direction and advising me on a regular basis.

Frank Mink
The Hague, December 2009

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Abstract

The results of a Master's thesis project, program "Economics & ICT", are presented in this paper. The thesis project is part of the study program "Informatics & Economics" of the Erasmus University Rotterdam. The research was carried out in cooperation with Steltix, an Oracle JD Edwards implementer with headquarters in Utrecht, the Netherlands.

The assumption at the start of the research was that many organizations have implemented some kind of an Enterprise Resource Planning system, but are not fully using all the benefits such systems can provide. This research focuses primarily on the benefits ERPs could have for better Performance Measurement.

A scientific literature study (chapter 3) reports all the important factors that play a role when talking about Performance Measurement. These factors are ERPs, Management Control, Performance Management versus Performance Measurement, Business Intelligence, Data Warehousing and Corporate Strategy. The latter factor is interesting, because research only partly focused on the impact of a company's strategy on their view on Performance Measurement. The results of the literature study are combined and put into a theoretical framework to show the relations between all the important factors (chapter 4).

The literature study was complemented with an extensive interview with an Oracle expert, and frequent exchanges of ideas and thoughts with Steltix employees. This formed the basis for a first set-up of a Performance Measurement (or Business Intelligence) tool. This tool is part of the development of a Business Intelligence product at Steltix. Steltix is developing the tool as there are signals from the market that there is a need for it. The first set-up of the tool consisted of a set of 40 key performance indicators divided in 6 functional domains chosen from a business perspective: Sales, Finance, Customer Service, Operations, Procurement and Inventory. Some technical aspects were added to the first set-up, such as a Data Warehouse layer. Date warehousing was added to the solution to minimize the effects on the performance of original data sources. The first set-up is described in chapter 5.

After the first set-up was created, a case study was conducted (chapter 6). This case study consisted of five company visits where people of the top management were interviewed and where the first set-up was discussed. The companies that participated were a mix of production companies and trade ventures. The trade ventures are generally more interested in finance related performance indicators, while production companies want to use Business Intelligence to further improve their operations. The assumption that companies have already optimized their operations could not be confirmed in this research.

The results of the interviews were used to improve the design of a Performance Measurement/Business Intelligence tool. The improvements of the design (chapter 7) mainly consisted of a change in the presentation layer by adding a causal relationship diagram, based on the DuPont scheme and the addition of the three layered model of strategy-tactical-operations.

The main conclusions of this thesis are:

- Organizations currently have no or very limited Performance Measurement solution in operation.
- A standard solution could implicate around 80% of the useful key performance indicators, the other 20% are depending on preferences resulting from an organizations' strategy.
- The differences between preferences in specific indicators or functional domains due to a specific strategy are visible. Cost leaders are much more interested in operational (production) indicators and in reducing costs. Organizations which have adopted the differentiation or segmentation strategy are more interested in quality.
- The set of KPI's should be limited, because it is impossible to manage an organization with information from too much indicators.
- Some measures should be balanced: this means that some indicators could create conflict situations. Based on strategy, the organization should decide how to balance these indicators.

The number of participating companies and the fact that the interviewees were all top managers are two of the most important limitations of this research. These limitations could have been reduced by interviewing a larger number of people within a company to find out what their thoughts were about Performance Measurement and to compare these results. Two interesting topics for further research are firstly the possibility of introducing benchmarking in a Performance Measurement tool to be able to compare the company's performance with the competitors in the market. And the second recommendation is to investigate the differences of Performance Measurement between large and small companies.

1 Introduction

In this chapter, a short introduction to the topic of ERPs and Performance Management is given by means of a problem description to show the importance of the research.

1.1 Problem description

In the past decennia, a lot of organizations have adopted and implemented enterprise wide information systems which can be summarized in the term Enterprise Resource Planning (ERP) systems. An ERP system can be characterized as an information system made up of different modules, each supporting the business processes. The modules are integrated and all gathered data are stored in a central database (Aernoudts, Boom, Pijl, & Vosselman, 2005). The fact that all data are centrally stored makes it possible to extract data into information. Theoretically, many more data and indirect information become available to the organization and to the people within the organization. Due to this effect business advantages can be expected. Because data become widely available, it is possible to use these data in order to control an organization. An example of this mechanism is the possibility of single storage of data, which can prevent unwished redundancy. Other advantages are the real-time storage of business process data and the business wide availability of data. These assumed advantages are the main reasons for organizations to implement such ERP systems. In an environment where organizations more and more depend on information technology, they want to remain competitive (Spathis & Constantinides, 2004). Organizations expect that ERP systems will create competitive advantages. In assuming that ERP systems create advantages, it is necessary to know what effects the system has on an organization. A lot of research is conducted into implementation issues and success- and fail factors of ERP systems. ERP systems support business processes and can be used as a tool to help to realize other goals. It is interesting to see what the impact of ERP systems is on the organization, or what relations exist between ERP systems and management control. One specific aspect of management control is the area of Performance Management. Talking about managing performance, the next question that presents itself is: what exactly is meant by performance and how can performance be measured. ERP systems store all process data in a single database, so we could assume that ERP systems offer opportunities for better Performance Measurement. This Master's thesis is the result of a research into the Performance Management aspect of ERP systems.

More information on Performance Management, Management control, ERPs, etc. is presented in the outcome of the literature study.

1.2 Importance of research

ERP systems have recently been the subject of a lot of research. But as clearly demonstrated in the working paper, '*Management Accounting Change and ERP, an Assessment of Research*' (Aernoudts, Boom, Pijl, & Vosselman, 2005) extant research focuses mainly on the implementation of ERP systems. Other research papers focus on critical success factors (i.e. (Akkermans & Helden, 2002)), or on the benefits of ERP systems. Some conclusions that can be drawn from researches conducted are that "ERP implementation success depends on the organizational fit of ERP" (Hong & Kim, 2002) or "that management control in an ERP-environment is not a property of the accounting function but a collective

affair were local control issues in different parts of the organization are used to create notions of global management" (Dechow & Mouritsen, 2005). Although, some research did focus on management control change (i.e. (Dechow & Mouritsen, 2005), (Quattrone & Hopper, 2005), it is clear that there is still a lot of research to be done. The goal of the study described in this paper was to find out what the relationship between ERP systems (Oracle JD Edwards in particular) and Performance Measurement is. Are possible benefits of ERP systems for Performance Measurement in organizations fully exploited? The study has a highly exploring function in finding a structured approach for implementing Performance Measurement.

The trust in ERP implementations is challenged according to the number of articles written and researches carried out in the recent past. If new benefits of ERP systems can be elaborated, the trust in ERP systems overall may rise. Current users of ERP systems can increase their benefits when applying better Performance Management.

1.3 Research objective

The objective of this Master research project is to develop a useful model for organizations to optimize the application of Enterprise Performance Management by using ERPs. The model can be used as a starting point by organizations wanting to implement better Performance Measurement using ERPs. Part of the study is to investigate the relationship between an organization's strategy and their views about Performance Measurement.

Part of the research was done at Steltix Netherlands BV. This company aims to provide their customers with the basic product (Business Intelligence tool) to profit from their ERPs. The research therefore had a highly practical character and resulted, apart from the development of a model, in establishing a standard solution for default performance measures for Oracle JD Edwards customers. Steltix did have some requirements for this end-product: (i) fast deployment of the product, (ii) it must use Oracle JD Edwards as main source and (iii) it should focus on organizations operating in a manufacturing and distribution industry (preferably the food and beverage industry).

1.4 Research questions

When doing research into the relationship between ERP and Performance Management various questions can be asked, for example: do ERPs provide the promised benefits on Performance Measurement? If so, how? If not, why not? What can be considered to be Performance Management? What is the aim and goal of the model to be developed? What functional requirements can be expected? Are there any existing models that can be used? To streamline the amount of questions and to limit the scope of this research, some main and sub research questions were formulated.

1.4.1 Main questions

The main questions for this research project were formulated as follows:

1. *How can ERPs successfully add value to organizations by providing more effective Performance Measurement?*
2. *In what way should strategy be used in Performance Measurement?*
3. *How can these aspects result in a framework to improve Performance Measurement in organizations?*

1.4.2 Sub-questions

In order to be able to answer the main research questions suitably, some sub- questions were formulated:

1. *What is meant by management control, what is Performance Management / measurement, what are ERP systems?*
2. *What key performance indicators in which functional areas are important in the food and beverage sector (standardization)?*
3. *How can these performance indicators be measured (which input variables are important)?*
4. *Can these performance indicators be measured without an ERP system? In what way are these indicators measured without ERP?*
5. *Why are benefits of ERPs not yet fully exploited to improve Performance Management?*
6. *Which frameworks or roadmaps exist on Performance Management (in relation to ERPs)?*
7. *How should an organization's strategy be related to Performance Management?*
8. *What changes are needed when an organization alter their business strategy? Is it easy to adapt these changes in Performance Measurement?*

2 Research Approach and Methodology

In this chapter, the approach of the research project will be explained. When researching the issue of the relationship between ERP and Performance Measurement it is essential to apply a structured and systematic approach. In doing so it will be possible to define answers for the research questions and thus add value to science.

This research paper consists of three main parts:

1) Literature review
2) Analysis
    a. design of a model
    b. validation of the model
3) Conclusions

In the following paragraphs, these items will be clarified.

2.1 Literature study

Figure 1, the structure of the research project is visualized. The first part of the project consisted of a literature review whereby the theory of ERPs and Performance Measurement was analyzed. Part of this literature review was to find out if any frameworks or models exist that supported the relation between Performance Management and ERPs. A lot of research was already done on the ERP topic, less research was conducted on ERP in relation to Performance Management. Was ERP used at all for Performance Measurement purposes? Do organizations have other ways to measure their organizational performance? As Performance Measurement has a direct relationship with the strategy of an organization, this literature study also focused on strategy. Exploring existing literature will clarify matters.

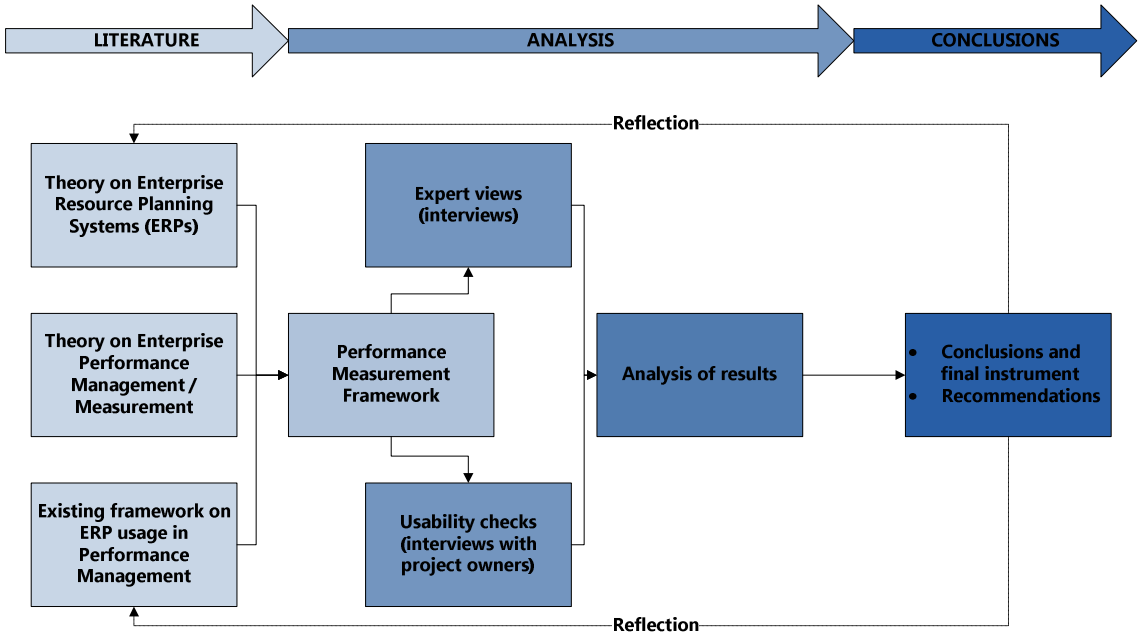

Figure 1: Research structure

2.2 Design of a framework

It is widely accepted that the added value of ERPs in relation with Performance Measurement is not yet fully exploited. In this part of the research project, a framework was designed to help organizations turn their business process data into clear performance measures. This framework was the starting point for the development of a Performance Measurement (Business Intelligence) tool at Steltix (the OBI Connector). Different aspects from the literature study and existing frameworks were used to generate this framework.

2.3 Analysis

When the framework had been created, it was validated by qualitative research. This qualitative research consisted of interviews held with problem owners in the businesses and of the outcome of interviews with experts. The results of the interviews were used to improve the design of the framework and to discover the desires of problem owners. The best validation of the framework would be a practical implementation. But ERPs and Performance Measurement implementations are long-term projects and therefore beyond the scope of this research.

2.4 Conclusions and reflection

When the modeling part was finished and the framework validated in the analysis part, the final version of the framework was used to draw conclusions. These conclusions were then reflected upon in the scope of the literature study. Finally, the limitations of this research project were indicated and explained. To conclude the project recommendations for further research were made.

3 Theoretical concepts

3.1 Introduction

A literature study was conducted to gain insight in current theoretical views on the topics related to the research project. It is important to know what the meaning is of specific terminology, and it forms the foundation for the study. This part of the literature study focuses on the definition of different terms and phrases and on research already carried out on related topics.

All factors playing a role in Performance Measurement and Enterprise Resource Planning systems are connected.
Organizations use *ERPs* (*chapter* 3.2) as massive information systems that contain all business process data in a central database. These data can be turned into management information which can be used to manage the organization. This concept is made clear in the paragraph about *Management Control* (chapter 3.3). When managing an organization it is of vital importance to know how the organization is performing. Defining the performance of an organization is necessary in order to identify the strategic objectives of that organization. Therefore, the concepts of *Corporate Strategy* (3.8) and *Performance Measurement* (3.4) are explained. Performance Measurement is often aligned with *Business Intelligence* (3.5). The difference between these concepts is expounded. When data from massive databases are transferred into information, the technical concept of *data warehousing* (3.6) plays an important role. Data warehouses are used to store data in an efficient manner to use the data as information more efficiently. In chapter 4, all concepts are presented in a clear overview.

3.2 Enterprise Resource Planning systems

3.2.1 What is an Enterprise Resource Planning system?

In literature studies the concept of Enterprise Resource Planning Systems (ERPs) is often the research topic. Different definitions are used in various studies. For example, the definition used by (Rashid, Hossain, & Patrick, 2002) is: "Enterprise resource planning systems or enterprise systems are software systems for business management, encompassing modules supporting functional areas such as planning, manufacturing, sales, marketing, distribution, accounting, financial, human resource management, project management, inventory management, service and maintenance, transportation and e-business. The architecture of the software facilitates transparent integration of modules, providing flow of information between all functions within the enterprise in a consistently visible manner."
Another definition commonly used is "Enterprise Resource Planning (ERP) software (synonyms are enterprise systems, integrated vendor software, integrated standard software packages, enterprise business/wide systems, and enterprise application systems) can be defined as customizable, standard application software which includes integrated business solutions for the core processes (e. g. production, planning and control, warehouse management) and the main administrative functions (e. g. accounting, human resource management) of an enterprise." (Rosemann & Wiese, 1999).
Both definitions aim more or less the same, but a more simplified definition is preferred. The next definition implies all the same important characteristics of ERPs. In this Master's thesis, this definition is used because of its shortness and clarity.

Enterprise Resource Planning system

"An ERP system can be characterized as an information system made up of different modules, each supporting the business processes. The modules are integrated and all gathered data is stored in a central database" (Aernoudts, Boom, Pijl, & Vosselman, 2005).

The notion in all definitions of ERPs is to reach a "seamless integration of all the information flowing through the company" (Davenport, 1998). This indicates that all process related business data are stored in one information system. ERPs are transaction-based and widely integrated within companies. Therefore, it is possible to retrieve all relevant business information from raw data. This information can be used to measure the performance of organizations.

ERPs often replace a lot of single applications used in an organization and integrate different systems. In the figure below (Figure 2), this integration is visualized.

Figure 2: Overview of (possible) ERP system (Secured Enterprise Applications, 2009)

3.2.2 What not is an Enterprise Resource Planning system?

In many articles and publications and in the mindset of people wrong assumptions exist about what an ERPs is or what it can do. It is therefore important to indicate what not an ERPs is. As the definition already shows, ERPs support the business processes. It is not a decision support system; ERP provides data but is not a system that provides information to the users or to management. If organizational process information is needed to support the decision making process, additional systems are installed on top of the ERPs. If an organization wants to manage its performance, a Performance Management System (PMS) is required. This PMS is used to translate data from the ERPs into information. Nowadays, data warehouses are used to extract data from the ERPs for other purposes. More about data warehouses in paragraph 3.6.

3.2.3 Brief history of ERP evolution

ERPs are defined as an information system supporting business processes. It may be clear that such information systems are not invented from one day to another. Figure 3 shows how ERPs developed over

the years. It all started in the 1960s with inventory control packages. These packages were used to keep control (see management control) over existing inventories of companies. Later on, these packages evolved into systems that were used for the planning of parts needed for production. In the 1980s, the evolution moved forward to different areas in organizations. Production, HRM, Finance, etc. were included. Later on, ERPs evolved into the current state as defined before. (Rashid, Hossain, & Patrick, 2002), (History and Evolution of ERP, 2005)

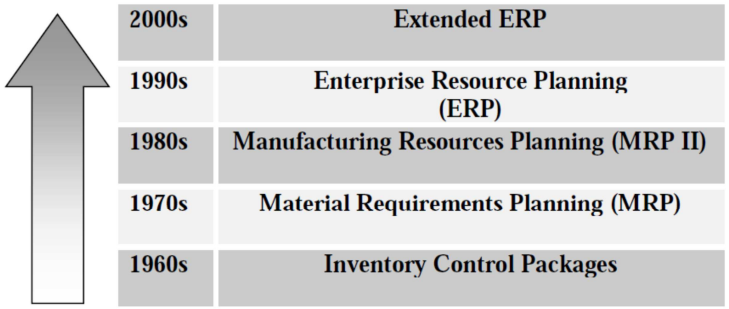

Figure 3: The evolution of ERP systems (Rashid, Hossain, & Patrick, 2002)

3.2.4 Benefits and value of ERPs

A lot of research focused on the benefits and added value of ERPs. *Umble et al* identifies two main advantages: 1) a unified enterprise view of the business that encompasses all functions and departments and 2) an enterprise database where all business transactions are entered, recorded, processed, monitored, and reported (Umble, Haft, & Umble, 2003). Another extensive explanation of the benefits is that "the adoption of ERP systems leads to more efficient operations as measured by inventory turnover (IT) and fixed assets turnover (FAT) and, to a lesser extent, efficiencies in marketing, sales and distribution as measured by accounts payable (AP) management. Furthermore, these improvements lead to increases in overall performance as measured by profitability and liquidity two years after the adoption of ERP systems" (Matolscy, Booth, & Wieder, 2005). There is much more information available about the benefits of ERPs. All studies show that the trust in ERPs is very high and lots of benefits are foreseen. In the article of Matolscy, empirical evidence was found that the organizational benefits are indeed realized. In paragraph 3.2.8 the drivers for ERPs implementations are explained.

3.2.5 Pitfalls of ERPs

Besides the promised benefits of ERPs, studies also mention pitfalls of ERPs, which mostly focus on the implementation of ERPs. As the most significant cause of failure, *Hsu et al*, identify "inadequate project definition" (Hsu, Sylvestre, & Sayed, 2006). Chung identifies three types of failures or issues with ERPs: Inflexibility, Long implementation periods and Overly hierarchical organizations (Chung, 2007).
The number one pitfall according to (Earls, 2009) is that organizations are not open to change. The built up set of (often customized) applications used in an organization fits the end users very well. The added value of ERP systems should be made clear to the end users in a proper way to remove user resistance. On the topic of change management and ERP implementations, literature is also widely available (Aladwani, 2001). However, the research for this thesis does not focus on pitfalls of the implementation phase but on the benefits ERPs could have for Performance Management.

3.2.6 Major players on the ERP market

During the evolution of Inventory Packages into ERPs, the number and size of manufacturers of ERPs varied a lot. One of the main reasons was takeovers in the past. From the start SAP is one of the biggest players in the market and in 2006 it was twice as big as Oracle. The last large merger of companies was the takeover of PeopleSoft by Oracle. Earlier, PeopleSoft already took over JD Edwards. In Figure 4, an overview of market shares of the top 10 ERP manufacturers in 2006 is shown. SAP and Oracle serve more than 60% of the whole ERP market.

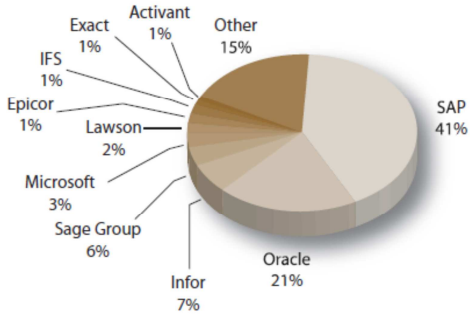

Figure 4: Top 10 ERP vendors in 2006 (Jacobson, Shepherd, D'Aquila, & Carter, 2007)

3.2.7 The adoption of ERPs

In the last decade of the last century ERPs were adopted more and more by different companies. The vendors of ERPs not only focus on the big companies anymore but also on midsized companies as shown in the article of Everdingen, Hillegersberg, & Waarts (2000). Obviously a main reason for vendors is the huge potential of the midsize companies market. As can be seen in Figure 5 and Figure 6, the Netherlands is one of the progressive adopters of ERPs. The food and beverage sector is an important sector for the vendors. More recent figures give a better insight in ERPs adoption. Another interesting notion which can be derived from these figures is that expectations of ERP adoption in the future are high.

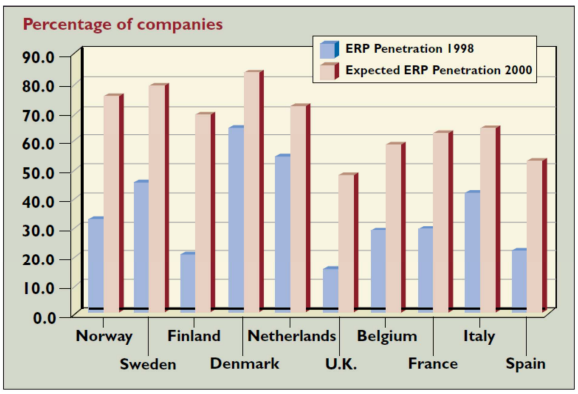

Figure 5: ERP penetration per country

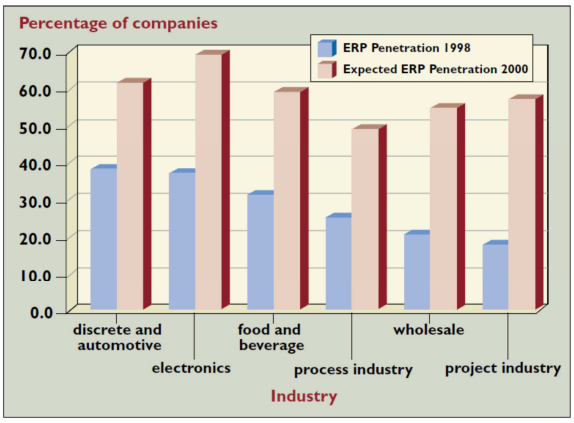

Figure 6: ERP penetration per industry

3.2.8 ERP implementation drivers

The choice of implementing and using ERPs is always driven by certain reasoning. Roughly three triggers can be identified. It is not difficult to identify these triggers, but it is difficult to indicate which of these triggers is the most important one. However, it is expected that the presented order is correct (Buytendijk, 2009):

- **System consolidation**
  The replacement of current (not supported legacy) applications and information systems triggered by four more reasons:
  - Millennium change
  - Introduction of euro (€)
  - New international accounting standards: IFRS
  - Missing functionality
- **Effectiveness**
  Realize and establish new and better processes, with possibility to use standard processes
- **Transformational**
  Changing the complete business model

3.2.9 Operational Excellence

As stated earlier, ERPs are transaction-based and process oriented information systems. In other words: ERPs support operations. In the previous paragraph, the three main drivers were indicated, but it is not very clear to what extent each driver is responsible for the choice of implementing ERPs. What all reasons have in common is that organizations want to improve operations. This is done by improving business processes, or by streamlining the business processes. This concept is called 'operational excellence'. By improving the operations, organizations are trying to remain competitive. Some people believe that it almost impossible to be competitive on operational excellence; some people however believe that a lot of organizations can still improve their operations a lot. Within the aspect of operational excellence, roughly three pillars can be identified.

Quality Organizations want to make products of the highest *quality* possible. By streamlining business processes and the possibility to measure performance with the help of ERPs, it is possible to improve the quality of the end products. (Buytendijk, 2009)

Costs For almost all organizations (excluding non-profit) the final goal is to maximize profit. Of course the selling price of the goods sold is a key driver for maximizing profit, but the other factor which determines the profit is *cost*. With the help of an ERP it is possible to lower the costs. This can, for example, be done by improving inventory management. (Buytendijk, 2009)

Time/speed The production cycle time is the third pillar of operational excellence. Customers want their ordered products as soon as possible. For organizations it is not acceptable to hold a large amount of products in stock. Holding products in stock can be very expensive and in the case of the food and beverage sector, products can have a best before date which limits stock possibilities at all. (Buytendijk, 2009)

The three pillars are sometimes in conflict with each other. When the cycle time decreases it is likely that the chance of making mistakes is higher which reduces overall quality. When quality is improved, it is likely that this will cost some money, for example because more expensive raw materials are purchased. The fact that conflicts can arise, recognizes that operational excellence is not a stand-alone target for organizations. Which pillar gets the most attention, is highly depending on the specific targets set by an organization. These targets are derived from the organization's strategy.

3.3 Management Control

In the previous paragraph, the conclusion was drawn that operational excellence depends on an organization's strategy. When an organization has set its strategy and defined some goals or targets, the management of the organizations wants to control this. When an organization is not performing well, the organizations should be managed in such a way that performance is aligned with strategy again. This concept is summarized by the term 'management control'.

3.3.1 What is management control?

Management control is a difficult term to define precisely. A definition given by Anthony is: "The process by which managers influence other managers of the organization to implement the organization's strategies." (Anthony & Govindarajan, 2006). Management control is more simplified defined as the process of controlling an organization. The easiest visualization of control is shown in Figure 7. It contains four phases of control: plan, do, check and act. It is not possible to classify one of the phases as the first one, because it is a continuous loop. When an organization defines its strategy for the upcoming period, *plans* are made on how to achieve the targets. While *doing* all the right things to achieve the goals, the organization has to *check* if the right actions have been taken and if the actions are performed correctly. If necessary the organization has to *act* in such a way that the goals will be achieved. The result is a new *plan*. This process is a continuous loop in almost every organization. The research for this paper focused mainly on the *check* part of the control loop as ERPs support this checking by supplying performance information. The focus is on measuring process information in the organization.
In this research, the definition set by Anthony & Govindarajan was used.

Management Control

The process by which managers influence other managers of the organization to implement the organization's strategies (Anthony & Govindarajan, 2006)

Figure 7: Control loop

As it may be quite obvious that all four phases of the loop are equally important, most organizations tend to 'forget' the check and the act part of the loop. In the next paragraph, the term Performance Management is explained more extensively and its relation to management control and ERPs is described. It is significant to understand that management control is not only about numbers, but more importantly, it is about people. When an organization defines its strategy, all people need to be involved.

3.3.2 Management Excellence

Some people believe that creating operational excellence is not the best way to compete with the competitors in the market these days. The reason they believe this is that all organizations want to excel in operations and lots of organizations implement ERPs to help them in this process. Customers expect a minimum level of quality, service and a good price. For example, when a bank advertises with a high accessibility of the service desk, it will not convince the customer because that is a minimum requirement for the customers. Buytendijk identifies 'management excellence' as the next step in improving the performance of organizations. In management excellence again three pillars can be distinguished: being smart, being agile and being aligned. Where operational excellence is a good strategy perspective for the short term, management excellence should be a better perspective on the long term (Buytendijk, 2009).

An important question of course is what is meant by being smart, agile and aligned? In the first issue of the Journal of Management Excellence the three terms are elaborated as follows:

Smart "There is no shortage of data about the market, or about your internal operations. The problem is that everyone has access to the same data. The question is how you interpret the data, and what you do with it." (Oestreich & Buytendijk, 2008)

Agile "Competition comes from adjacent markets, for instance cable TV companies competing with the classical telecommunications companies. New technology developments have changed business models. Internet-based applications allow mass customization; customers ordering products and services themselves, while specifying the configuration and options in a detailed way. The organizations most likely to succeed are the ones that are agile and can adapt."(Oestreich & Buytendijk, 2008)

Aligned

"In order to be successful, organizations throughout the value chain need close collaboration. Also, most innovation today comes from collaboration between companies. Think of Apple and Nike combining forces, offering jogging statistics on your iPod. Or think of competing airlines that form collaborating global alliances such as OneWorld, SkyTeam or Star Alliance. Strategic advantage comes from managing relationships rather than managing processes." (Oestreich & Buytendijk, 2008)

The check part of the management control cycle is in fact measuring the current performance. In the next paragraph, the concept of Performance Measurement is explained.

3.4 Performance Management & Measurement

3.4.1 What is Performance Management?

When an organization sets its strategy and tries to align everybody and every process to fit the strategy, the organization probably wants to manage the performance. This means that they want to check if the organization performs according to set targets. If the organization is underperforming on certain aspects, the responsible manager can act to change this. To compare the set targets with the current performance, the performance needs to be measured. In general, Performance Management is answering the question: 'are we meeting our goals?'

3.4.2 What is Performance Measurement?

Simply stated, Performance Measurement is the process of measuring (checking) how your processes are performing. In Performance Measurement and Evaluation: Definitions and Relationships (GAO/GGD-98-26), the U.S. General Accounting Office (GAO) provides the following definition: "Performance measurement is the ongoing monitoring and reporting of program accomplishments, particularly progress towards pre-established goals. It is typically conducted by program or agency management. Performance measures may address the type or level of program activities conducted (process), the direct products and services delivered by a program (outputs), and/or the results of those products and services (outcomes). A "program" may be any activity, project, function, or policy that has an identifiable purpose or set of objectives."

Measures are quantifiable and consist of a number and a unit where the number shows 'how much' and the unit gives a 'meaning' to that number (Ferguson & Yung, 2007). Some research shows that Performance Measurement is moving up to Performance Management (Folan & Browne, 2005). In Figure 8, the position of measurement in the whole Performance Management process is represented by Folan and Browne.

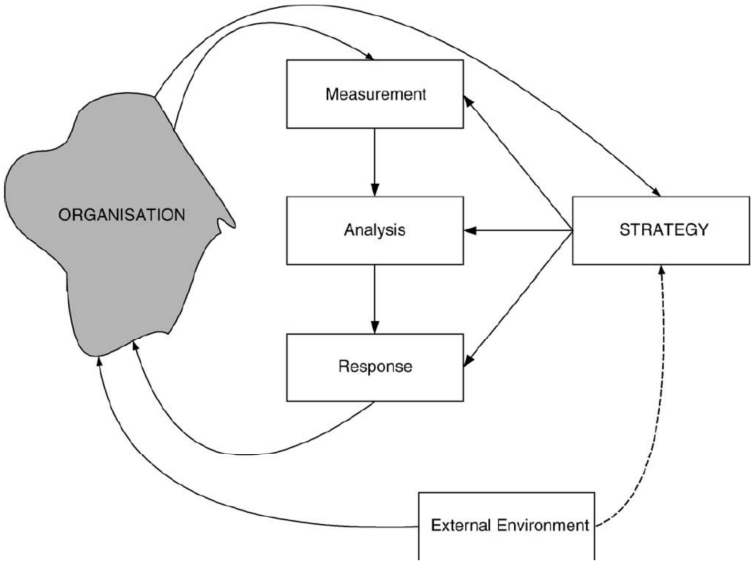

Figure 8: Relation between measurement and management (Folan & Browne, 2005)

This information leads to the following definition of Performance Management and Measurement.

Performance Management

"The combination of management methodologies, metrics and IT that enable users to define, monitor and optimize results and outcomes to achieve personal or departmental objectives while enabling alignment with strategic objectives across multiple organizational levels" (Rayner, 2006).

Performance Measurement

"Performance measurement is the ongoing monitoring and reporting of program accomplishments, particularly progress towards pre-established goals" (Shipman & Wholey, 2005).

Performance Measurement is often related to Business Intelligence. In the next paragraph, the concept of Business Intelligence is explained.

3.5 Business Intelligence

3.5.1 What is Business Intelligence?

The term Business Intelligence (BI) comprises all processes that are related to analyzing business information. The term is coined by Howard Dresner in the early 1990's. According to Gartner, BI is a top priority for a lot of IT managers (Watson & Wixom, 2007). The link with ERPs is evident. Where BI is used to analyze all sorts of management information, the data are derived from the ERPs databases. So BI is the process of translating process data into valuable business information. Which business information is valuable is determined by the strategy of the organization.

Business Intelligence

BI is an umbrella term to describe "concepts and methods to improve business decision making by using fact-based support systems." (Power, 2007)

3.5.2 Ready for Business Intelligence

The last years the interest in Business Intelligence is growing rapidly. While in the late nineties a congress about ERP & Business Intelligence was cancelled due to the lack of interest, nowadays BI is a very hot topic. Different reasons are elaborated but maybe the most important reason is that organizations are simply ready for it. In the beginning, it was difficult and very time consuming to gather all data together, but the increase in ERPs adoption makes BI much more applicable. Other reasons can be political (forced transparency, Sarbanes-Oxley), economical (margins under pressure due to globalization), social (stakeholders are much more interested in organization's background), technical (information growth is enormous, BI helps to organize), business (competing on analytics, information is competing service), investors (investors want to know more about a company than just profitability) (Buytendijk, 2009).

There are many arguments for using Business Intelligence, but not many organizations really have linked their ERPs with BI.

3.5.3 Business intelligence framework

Basically BI consists of two aspects: the technical aspect and the business aspect. The technical aspect is about how to get the process or transaction data (from the ERPs) into the BI system. The business aspect is about what information do you need to manage your organization? In Figure 9, a BI framework is shown. The two big arrows at the bottom show the different aspects of BI. The right arrow is named Getting data out, but a better name would be Getting information out. The whole *secret* about BI is translating data into information. Business intelligence is a very popular term and vendors of ERPs are developing BI tools which are used for Performance Management. Some companies specialize in BI and deliver such systems to their customers as their core business. The best known company is Cognos, which is recently taken over by IT giant IBM.

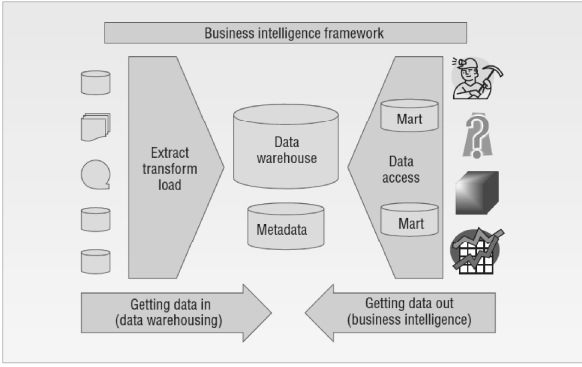

Figure 9: BI framework: data in, information out (Watson & Wixom, 2007)

3.5.4 Major players on the BI market

The growing interest in Business Intelligence worldwide automatically resulted in a growing interest by manufacturers of BI platforms. Recently the ERP supplier SAP has taken over Business Objects to strengthen their position on the market. For the same reason the big IT company IBM has taken over Cognos to give themselves a leading position. Oracle in this case was already busy with developing BI tools themselves. In Figure 10, the most recent Gartner quadrant for BI platforms is shown. There is an obvious relation between ERP suppliers which are trying to create a good position on the growing BI market. At least the two largest ERP suppliers (SAP & Oracle) have clear ambitions within the Business Intelligence topic.

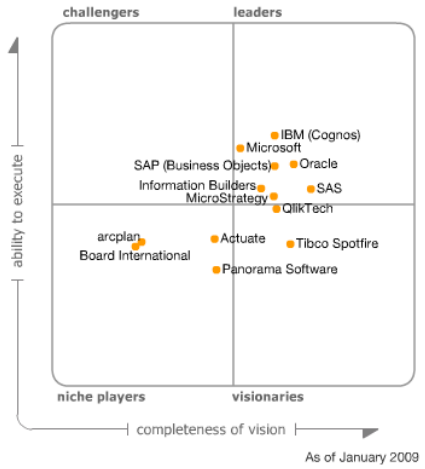

Figure 10: Magic quadrant for BI platforms (Richardson, Schlegel, Sallam, & Hostmann, 2009)

3.6 Data warehousing

ERPs databases are often enormously large. The obvious reason for this is that the database contains all transaction-based data which are processed through the organization. Although computing power is increasing continuously, database performance is still an issue. While computing power is increasing, the size of databases is also increasing, at least with the same proportions. Database performance can cause problems when Business Intelligence solutions are based directly on the production database. Therefore, most BI solutions are using so called data warehouses. In short: a data warehouse contains the data needed for the specific BI purpose and is an extract of production databases. The different data warehouse approaches are elaborated in the next paragraphs (mainly two approaches). There are three reasons for using data warehouses (Blaas, 2008):

Performance As mentioned before, the reason which is put forward mostly is performance. Because running queries on databases consume lots of computing power. BI queries will change over time which makes it almost impossible to perform these queries on large production databases. (Blaas, 2008)

Semantics Another big advantage of using data warehouses is that is possible to execute the first step in the BI solution: turning data into information. When knowing what the final result of the BI solution should be, the data warehouse can be set up in a sensible way. For example, only useful information can be extracted

from the production database and database tables can be combined where possible. (Blaas, 2008)

Data integration It is possible that the ERP database used for a Business Intelligence solution does not provide all information needed. Data warehouses have the possibility to integrate data from different sources. For example, the human resources module of ERPs is not often used, but data warehouses can include the data from the used HR system. (Blaas, 2008)

3.6.1 Kimball – bottom up approach

The Kimball approach of data warehousing is basically driven by information need. Data marts are created specifically to provide the information to the end users. The data marts themselves are filled with atomic data from the real data source (for example the ERPs database). It is also possible to combine data marts. (Kimball & Ross, 2002)

3.6.2 Inmon – top down approach

The approach of Bill Inmon is the opposite way: first all data from original sources (such as ERPs database) are loaded into the data warehouse. The data marts which provide the business value are created later on top of this lowest data layer. (Inmon, 2002)

The conclusion of the two data warehouse approaches is that the one is driven by data availability and the other one is driven by information need. Both have their advantages and disadvantages and it depends on the situation which approach should be applied.

3.6.3 Data warehousing pitfalls

Just-BI, a Business Intelligence consultant in The Netherlands identifies five pitfalls in data warehousing (Blaas, 2008):

1) Neglect to acknowledge that data warehouse success is tied directly to user acceptance. If the users do not accept the data warehouse as a foundation for improved decision making, then your efforts are futile.
2) Presume that the business, its requirements and analytics, and the underlying data and the supporting technology are static.
3) Load only summarized data into the presentation area's dimensional structures.
4) Failure to embrace or recruit an influential, accessible, and reasonable management visionary as the business sponsor of the data warehouse.
5) Become overly enamored with technology and data rather than focusing on the business's requirements and goals.

These pitfalls are arguable, but at least they provide an insight in the difficulties of data warehousing.

3.7 Selection of existing frameworks and methods

In this paragraph a selection of existing frameworks for the topic of Performance Management / Measurement and ERPs is shown and a summary of their benefits is given. Literature about Performance Measurement and Management exists, and also a lot of information about ERPs is available, but research linking both subjects has been conducted only rarely.

3.7.1 Medori and Steeple

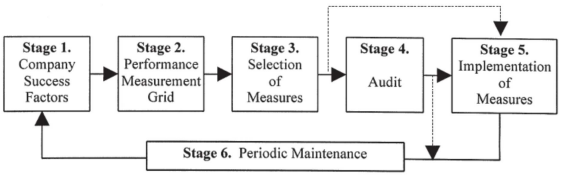

Figure 11: Performance Measurement Framework (Medori & Steeple, 2000)

Medori and Steeple have developed a framework for Performance Measurement containing six stages (see Figure 11). This framework starts with identifying or using the Company Success Factors (CSF's). This means that in this framework the strategy of an organization has already been translated into these CSF's. The implementation stage (5) of the framework is interesting in relation to ERPs, because it contains the part of retrieving data. This stage contains different steps: 1) Title, 2) Objective, 3) Benchmark, 4) Equation, 5) Frequency, 6) Data source, 7) Responsibility, 8) Improvement. A strong quality of this framework is that it provides a structured approach (step-by-step) for implementing performance measures. A disadvantage is that it only focuses on Performance Measurement and it does not fit in a strategy framework.

3.7.2 Canada

In an article by Canada, three important steps are identified towards Performance Measurement: 1) Identifying Indicators, 2) Collecting Data and 3) Analyzing Data and Using Information (Canada, 2005). The obvious limitation is that this framework also only focuses on indicators and measuring those indicators. The relation with the specific organization is not made and therefore it is probably too simplistic to be useful. The fact that to apply Performance Measurement you need to 'identify indicators' and 'collect data' is common sense.

3.7.3 Bradley

Bradley developed a Performance Management design (Figure 12) in which strategy specific performance measures and pre-defined measures are combined together resulting in Performance Management application. While this framework is seen as a Performance Management design by Bradley, it only focuses on metrics, so the distinction to measurement should be made. As a Performance Measurement framework it has a very interesting aspect as it implements CSF's related to the specific strategy of an organization and it also uses pre-defined measures. This is a combination of the top-down (driven by information need) and bottom-up (drive by data availability) approach.

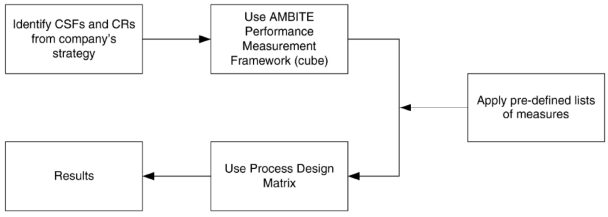

Figure 12: Performance management design (Bradley, 1996)

The different frameworks all have things in common and all have their usable and less usable parts. The greatest advantage of each framework is:

- Medori & Steeple: Use of strategy when defining measures
- Canada: Simplicity
- Bradley: Use of predefined measures

These characteristics are used in the development of the framework (chapter 0).

3.8 Strategy of organizations

The two types of excellence which are elaborated before (operational and management) are driven by the strategy of an organization. In this paragraph some literature about strategy (in relation to Performance Measurement) is elaborated.

3.8.1 Top down or bottom up?

Managers want to control their organization (whether the complete company or just a department) in the best possible way to achieve the goals set in their strategy. Two approaches can be identified.
The top-down approach got a huge boost when Kaplan and Norton introduced their widely known Balanced Scorecard (BSc). The BSc is raised from the need of a framework which not only uses financial measures to control the organization but also non-financial measures (resulting in four perspectives: financial, internal, customer and learning & growth). Nowadays, organizations define their strategy which results in a BSc. The BSc is used to check if set goals are still being achieved or not.
The bottom-up approach is the other way around: available data / information are used to define important measures which should be checked regularly. So the main difference is that the top-down approach is strategy driven and the bottom-up approach is data driven. The same concept is noticeable at the data warehouse part. Here there are also two approaches for building data warehouses; top-down and bottom-up. The data availability approach can result in a set of standard key performance indicators which are overlapping with key performance indicators derived from the organization's strategy. With a massive amount of data available, the possible set of KPI's is nearly unlimited. Based on their strategy organizations should make well considered choices about what to measure.

Some management approaches which are pretty well known are:

- Levers of control (Simons, 1994)
- Balanced Score Card (Kaplan & Norton, Balanced Scorecard, Translating Strategy into Action, 1996)
- Value chain framework (Porter, 1985)

In the next paragraphs, some of the most well-known management approaches are clarified. All these approaches show the relation between strategy and Performance Management.

3.8.2 Levers of control (Simons, 1994)

Simons introduced his "Levers of Control" framework (Figure 13) which should help managers "to manage the tension between (value) creation and control (managing and measuring value)" (Simons, 1994). The levers he mentions are: Core Values, Risks being Avoided, Strategic Uncertainties and Critical Performance Variables. These levers are controlled by:

- Belief Systems; used to direct and inspire the search for new opportunities

- Boundary Systems; used to set limits on opportunity seeking behavior
- Interactive Control Systems; used to motivate, monitor and reward achievement of specified goals
- Diagnostic Control Systems; used to stimulate organizational learning and the emergence of new ideas and strategy.

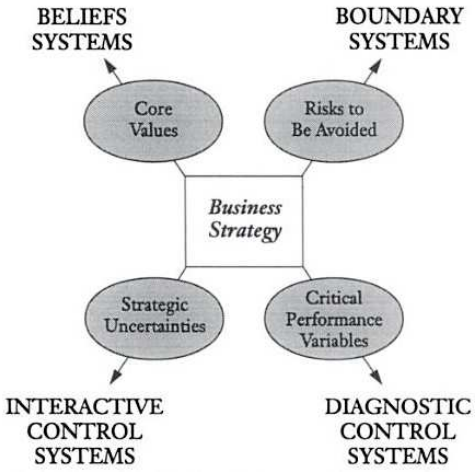

Figure 13: Levers of control (Simons, 1994)

At the lower right corner of Figure 13, the term Critical Performance Variables is used. This is the link to Performance Measurement. Performance measurement is called diagnostics in this case. This framework shows the relation between strategy and Performance Measurement from a different point of view.

3.8.3 Balanced Score Card (Kaplan & Norton, Balanced Scorecard, Translating Strategy into Action, 1996)

The Balanced Scorecard is developed for the need of a framework which not only uses financial measures to control the organization but also non-financial measures (resulting in four perspectives: financial, internal, customer and learning & growth). Nowadays, organizations define their strategy which results in a BSc. The BSc is used to check if set goals are still being achieved or not. There is a strong relation between the four perspective used in the BSc, and the different elements in a BSc are often originated from a strategy map, or a causal diagram which relates the different elements.

Four possible steps to define KPI's from an organization's strategy (Haas, 2008):

1) Resume strategic points of departure on 1 single page
2) Identify critical value drivers in relation to ultimate goals
3) Reason causal relations and draw up the strategy map
4) Define key performance indicators (and set targets)

3.8.4 Value chain framework (Porter, 1985)

"Competitive Advantage" takes strategy from a broad vision to an internally consistent configuration of activities. Its powerful framework provides the tools to understand the drivers of cost and a company's relative cost position. Porter's value chain enables managers to isolate the underlying sources of buyer value that will command a premium price and the reasons why one product or service substitutes

another. He shows how competitive advantage lies not only in activities themselves but in the way activities relate to each other, to supplier activities, and to customer activities. "Competitive Advantage" also provides for the first time the tools to strategically segment an industry and rigorously assess the competitive logic of diversification".

Figure 14: Value Chain Framework (Porter, 1985)

This Value Chain Framework shows the primary activities of organizations, split up into five functional domains. Although this framework does not directly show the relation between strategy and Performance Management, it gives insight in operational activities which can be measured with the help of ERPs. Different managers can be responsible for different functional domains. This may be important in developing a Performance Management roadmap.

3.8.5 Common corporate strategies

Some of the common ideas about corporate strategy are elaborated in this paragraph and after that, an attempt is made to link these to Performance Measurement. Two widely accepted and used streams in strategy theory are those of Treacy / Wiersema and that of the well-known 'mister strategy' Porter. Both identify three main strategies which are described in the next paragraphs.

3.8.5.1 Treacy & Wiersema

Operational Excellence

"Operationally excellent companies deliver a combination of quality, price, and ease of purchase that no one else in their market can match. They are not product or service innovators, nor do they cultivate one-to-one relationships with customers. They execute extraordinarily well, and their proposition to customers is guaranteed low price or hassle-free service, or both." (Treacy & Wiersema, 1995)

Customer Intimacy

"A company that delivers value via customer intimacy builds bonds with customers like those between good neighbors. Customer-intimate companies don't deliver what the market wants but what a specific customer wants. The customer-intimate company makes a business of knowing the people it sells to and the products and services they need. It continually tailors its products and services and does so at reasonable prices. Its proposition is: "We take care of you and all your needs," or "We get you the best total solution." The customer-intimate company's greatest asset is its customers' loyalty." (Treacy & Wiersema, 1995)

Product leadership

"Companies pursuing product leadership continually push products into the realm of the unknown, the untried, or the highly desirable. Reaching that goal requires that they challenge themselves in three ways. First, they must be creative. More than anything else, being creative means recognizing and embracing ideas that may originate anywhere--inside the company or out. Second, they must commercialize their ideas quickly. To do so, all their business and management processes are engineered for speed. Third and most important, they must relentlessly pursue ways to leapfrog their own latest product or service. If anyone is going to render their technology obsolete, they prefer to do it themselves. Product leaders do not stop for self-congratulation. They are too busy raising the bar." (Treacy & Wiersema, 1995)

3.8.5.2 Porter

Cost leadership

"Cost leadership, the most commonly adopted strategy, involves the ruthless pursuit of economy and efficiency in all business operations with the aim of providing the product or service to the buyer at the lowest possible price." (Porter, Competitive Strategy, 2002)

Differentiation strategy

"Differentiation involves developing one significant aspect of a product in order to set it apart from its competitors. One or more product functions, such as brand image and identity, technology and features or customer service and dealer network; is developed to a high quality level and the resultant added value perceived by the customer offsets the impact of a higher price." (Porter, Competitive Strategy, 2002)

Segmentation strategy

"The focus strategy may be viewed as a variation on the differentiation approach, in that it involves targeting the product specifically towards the needs of a highly defined market segment." (Porter, Competitive Strategy, 2002)

The strategies of Porter are used a lot in research, because it is easy to use and it is a clear classification of organizations strategies. This classification is used during the data collection part of this research (chapter 6). One of the main research questions is to find out what the relation between different strategies and the view on Performance Measurement is. During the case study, this relation was checked with the interviewees.

4 Positioning Performance Measurement: a theoretical framework

4.1 Introduction

In the previous chapter, some theoretical concepts were explained. These concepts vary from ERP systems, which imply a technical approach, to concepts of corporate strategy. In this chapter an effort is made to link these concepts together into a theoretical framework. By linking the concepts the position of Performance Measurement becomes more evident. The expert interview with Frank Buytendijk of Oracle (Buytendijk, 2009) was an important source for setting up the theoretical framework.

4.2 Expert interview: operational excellence versus management excellence

On the 26th of August of 2009, an interview with Frank Buytendijk was conducted. Buytendijk is Vice President Enterprise Performance Management at Oracle and has a background at Hyperion (Business Intelligence). He is eminently a person with extensive knowledge on the topic of Performance Management. More information about the interview can be found in Appendix A . Buytendijk added the perspectives of operational excellence versus management excellence to the framework. In his opinion most organizations have to focus more on management excellence, as it is difficult from an operational perspective to compete in the market. He suggested that the reason for this is that the customers of a company expect a minimum level of service which implies that the operations have to be perfect.

The idea of operational excellence and management excellence also affects the purpose of Performance Management and Business Intelligence. From an operational excellence perspective the information derived with BI is used to improve operational process, or to check whether the company is performing well according to its strategy. From a management excellence perspective the information is used to compete in the market in which the company is doing business. This assumption is used as the basic principle for the theoretical framework and is positioned on a horizontal axis.

4.3 The position of Performance Measurement

In the middle of the two concepts of excellence (operational and management), Business Intelligence (or Performance Measurement) is placed as the central concept. This is visualized in Figure 15. It shows the position of Performance Measurement in strategy context. Business Intelligence can contribute to both excellence perspectives:

1) Operational Excellence
   In this approach, BI is used to measure if operational processes are still performing in line with the set targets. The main question is 'are we doing the things right?' Organizations could still improve a lot considering operational issues and therefore improve their competitive position.
2) Management Excellence
   In this approach, BI is used to gather information and that information is applied to compete in the market. The main question in this case is 'are we doing the right things'?

The focus of the research for this thesis project was on the Operational Excellence perspective. The question: 'are we doing the things right' implies in fact the concept of Performance Measurement.

Therefore, Performance Measurement was placed on the operational excellence side of the horizontal axis. The research was conducted in cooperation with an Oracle JD Edwards ERP supplier.
Within this perspective two approaches are available:

- **Driven by information need**
  Based on the strategy, the organization sets targets and goals to achieve within the operational processes. Measuring these targets provides insight in how the organization is performing, and when the organization is underperforming, it offers the possibility to change things (control loop). ERPs deliver the data needed to measure targets.
- **Driven by data availability**
  One of the aspects of ERPs is trying to streamline processes in an organization. ERPs offer the possibility to use standardized ERP modules with standardized processes (of course some moderations to best fit the organization structure are possible). Standardization in organizations processes offers the possibility to standardize parts of Business Intelligence as well. ERP suppliers can supply their customers such standardized BI solutions as additional services. The benefit for the customers is that they do not have to 'reinvent the wheel'.

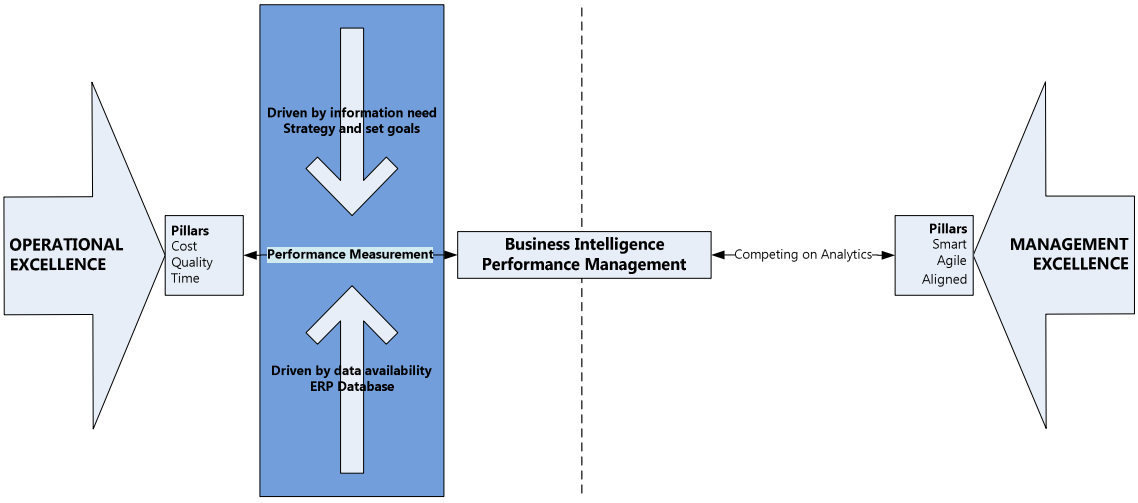

Figure 15: Position of Performance Measurement

Although the research focused primarily on Performance Management, the answer to the question 'what is performance?' is often derived from an organizations strategy. Therefore it is important to understand strategy frameworks first before developing a roadmap. Together with the possibilities offered by standardization an opportunity for organizations is available. But which steps should organizations take regarding this matter?

A framework is developed taking into account the following aspects:

Ability to change Organizations will sometimes have to change their strategy and, the Performance Measurement should follow these changes. If it is apparent to employees what is being measured and these measurements will improve automatically (often driven by rewarding based on targets).

Two-side approach Use the data availability approach as well as the information need approach. This offers (possibly) the best environment to control an organization.

4.4 Summary & aspects for framework set-up

A framework for a standard solution for Performance Measurement was developed with the main focus on operational excellence. In this framework, both the information need (from strategy), as well as data availability perspective are made transparent. Both perspectives are used to develop a standard solution for Performance Measurement in the next chapter.

5 Designing a Performance Measurement tool: framework set-up

5.1 Introduction

A framework set-up was developed and this will be explained in this chapter. The aim of the framework was to provide organizations with a standard Business Intelligence solution which can be used as a starting point for improving the use of BI solutions. The framework was developed in cooperation with Steltix and parts of it were used as input for the interviews with customers of Steltix. These interviews are further elaborated in Appendix C . In the next paragraph will be explained how the framework was developed. Next a set of standard KPI's will be clarified and the technical aspects of the standard solution are illustrated briefly. At the end, the framework itself is presented.

5.2 Approach of the framework

The focus of the framework was to develop a standard BI solution for customers of Steltix (the OBI Connector). All these customers use Oracle JD Edwards (JDE). However, the final BI product which is delivered by Steltix to their customers should be able to use other data sources as well. So, the solution should be more or less platform independent. This is the reason why the first approach was not from the JDE perspective, but from a business perspective. A second reason for this is that measuring performance in the organization is of course independent of the information systems in use. The final goal of the framework is to manage the organization in a more efficient way. All specific terms for modules etc. used in JDE are dropped.

The conditions of the framework are:

- Platform independent
- End product (for Steltix) is an easy-to-deploy Performance Measurement tool based on Oracle JD Edwards
- The solution should be scalable
- Low investment costs and development costs
- Independent data sources

5.3 Defining the set of KPI's

In the first set-up of the framework, different functional domains were filtered from both literature and conversations with ERPs consultants. Therefore the naming of functional domains was chosen from a business perspective. The final set of KPI's can be found in Appendix B . The functional domains which were used in the framework are:

- Finance
- Sales
- Procurement
- Operations
- Customer Service
- Inventory

Some obvious functional domains, such as Human Resources, Research & Development, Information Technology, etc. are not used in the framework. The reason for doing this is that the underlying modules in JDE are not often being used by organizations. This does not implicate that these areas are not interesting from a management perspective; they just fall out of the scope of the first framework. Where Performance Measurement is initially a business issue, in this first set-up, a data driven approach was used. The interest in the deliberately ignored domains was however tested in the interviews.

The list of functional domains was created with the help of literature (such as www.kpilibrary.com) and discussions with Steltix employees. The ERP consultants were somewhat biased to use specific terms of the Oracle JD Edwards system, so the use of additional sources was important.

Within the functional domains, a set of KPI's was developed. The total number of (initial) KPI's is 40. With the balanced score card in mind, the number of KPI's are (equally) divided over the different functional domains. However, most interesting performance indicators are probably finance or customer service related. Literature and KPI libraries were used to define a limited set of performance indicators. The total number of KPI´s is deliberately limited, because only standard indicators are used. A second reason for limiting the number of indicators is that it is impossible for managers to manage a high number of indicators. The set is limited to 6 or 7 per functional domain. These indicators are as much as possible business independent, to produce a standard solution. In addition to the list of key performance indicators, dimensions were added to the first set-up of the framework:

- Time/period
  This is a general dimension which can be used to compare indicators with values in the past. An example of this is: 'sales volume'. With the time dimension it is possible to compare the sales volume of last month, with the volume of the same month in the previous year.
- Geography (customers / country)
  This dimension is more specific. Using the example of sales volume again, with the dimension customers it is possible to dig deeper into the total sales volume to see which customers are responsible for a specific part of that sales volume. Or to see which country has the highest added value to the sales volume.

The complete list of key performance indicators, including their definitions can be found in Appendix B

5.4 Technical aspects

In the initial data-driven set-up, a data warehouse layer was implemented. Reasons for choosing a data warehouse layer are that different dimensions have to be added to the source data (so new tables must be created) and in the future different data sources may have to be added to the Business Intelligence solution. Also using the data source directly would have a huge impact on the performance of the ERPs (usually the ERPs is a core information system). A disadvantage of the introduction of the warehouse layer is that real-time insight in key performance indicators is not possible, but the delay can be reduced to one day by extracting the data from the ERPs to the data warehouse overnight.

The data warehouse layer was mainly built up according to the Inmon approach (see 3.6.2). This means that entire tables from the original data source are included in the data warehouse. The most important

reason for using this variation is that the primary ERPs database would otherwise become very large. Copying entire database tables offers the possibility to reorganize the original data source in a later stage. This implicates that attention must be paid to the process of choosing tables to prevent data loss. Duplicating the tables can be done in three different ways; all were implemented in the standard solution and the end-users can occasionally switch between them. Updating tables in the data warehouse from the original data source can be done as follows:

- **Insert / update**
  The data warehouse table is compared with the table of the original data source. When any records are changed, these are updated. If a new record exists, these are inserted into the data warehouse.
- **Full replace**
  The table is deleted from the data warehouse, and after that, a new copy is made from the original data source.
- **Snapshotting**
  An extra field (column) has to be added to the table containing the timestamp. This makes it possible to store different table states. This may be useful when it is necessary to compare the current situation of a KPI with the situation some time ago.

It depends on the specific situation how to decide which way is the most effective. A circumstance could be the frequency of changes. When a table changes often, it would be time consuming to find out which records have been changed and which not. In that case it might be a sensible solution to just fully replace the table. However, it is a waste to copy a table every time even when it has not changed at all. Finally, snapshotting should be used when it is necessary to make use of the aspect time as a dimension in Performance Measurement.

5.5 The framework

Before the actual Business Intelligence solution (OBI Connector) was produced, the first set-up was checked with customers. In Figure 16, this first set-up is visualized. In the further development of the OBI Connector the framework was extended.

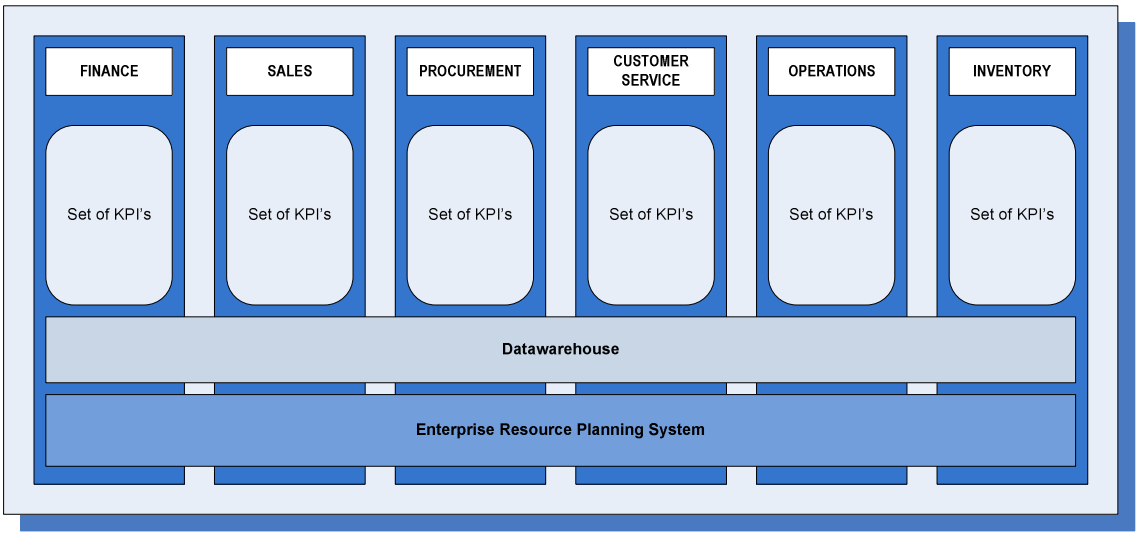

Figure 16: First set-up of framework

5.6 Summary & aspects for case studies

Some assumptions were made in the first set-up of a Performance Measurement:

- Limited set of functional domains
- Limited set of key performance indicators
- Two dimensions: (i) time and (ii) geography

These assumptions were checked in the actual business environment. This was done by interviewing customers of Steltix. The two most important issues derived from this first set-up were:

- The set of functional domains: are the domains not included in the set, actually not that interesting?
- The list of key performance indicators: are these indicators really the ones that should be used in a Performance Measurement environment?

In the next chapter, other purposes of the interviews are elaborated.

6 Data collection: testing the design

6.1 Introduction

In the previous chapter the first set-up of a Performance Measurement framework was described. Some assumptions were made developing the framework and these had to be verified in order to make the framework more acceptable. The verification took place through interviewing customers of Steltix. In the next paragraph the goals of the interviews will be explained. Information will be provided about the participating organizations and how they differ or what similarities they have. Finally, the approach of the case studies will be explained.

6.2 Goals of the case studies

The main objective of the different interviews was to verify the first set-up of the framework and the set of functional domains with underlying key performance indicators in particular. However, some other objectives could be identified as there are:

- **Find out how organizations are using Performance Measurement at this time (if at all)**
  Before the research for this Master's project started, it was assumed that organizations are increasingly interested in Performance Management and Business Intelligence in particular. The idea is that after years of growing interest in enterprise resource planning systems, the organizations which have implemented these systems want to take the next step. One goal of the interviews was to check whether organizations are currently already using some kind of Performance Measurement systems.
- **Find relations between corporate strategies and interest in different key performance indicators**
  The primary objective of Steltix is to develop a standard solution for Business Intelligence that can be used as starting point for further implementation of BI solutions. The standard solution should imply all important performance indicators standard for many organizations. One aim of the interviews was to discover how the strategy of an organization is related to the preference for functional domains or more specifically for some of the performance indicators.
- **Find out if interest in Performance Measurement is driven by data availability or information need**
  In chapter 4, an overview of Performance Measurement has been shown. One of the issues was the difference between an 'information need' and a 'data driven' approach. A goal of the interviews was to find out whether there is any interest in Business Intelligence and how this interest is originated. Managers are aware of the fact that there a lot of data is available that should be used to manage the organization (data driven); managers also have a clear target in mind and want to be able to verify set targets and check if they are reached (information need).
- **Find out current bottlenecks in successful Performance Measurement implementations**
  When organizations have implemented Performance Measurement systems they may face bottlenecks in using those systems. What are these bottlenecks and how to solve them?
- **Find out success factors of good Performance Measurement implementations**
  Information systems often fail because it is not clear beforehand what requirements should be met to be successful. Therefore, one goal of the interviews was to find out which factors or

characteristics of a Business Intelligence solution exactly contribute to the success of such a solution.

6.3 Participating organizations

In **Error! Not a valid bookmark self-reference.**, the organizations which have participated in the case studies are listed and described. The group of companies that participated is a mix of production companies and trade ventures, differing in size and located in various places in the Netherlands. The companies all have in common that they are international oriented; they are all doing business in other, overseas countries.

TABLE 1: ORGANIZATIONS WHICH HAVE PARTICIPATED IN CASE STUDIES

Company	Short description & characteristics	Type
Burg Groep	Burg Groep is a large producer of vinegar and syrups and is located in different countries in Europe. Headquarter is in Heerhugowaard (NL). The products are delivered in various packaging's, from bulk to small glass or plastic bottles.	Production
AudioNova	AudioNova is one of the largest suppliers of hearing aids in the Netherlands and also has noteworthy market shares with different brand names in other countries (8 in total). These countries are Netherlands, France, Germany, Italy, Belgium, Portugal and Denmark.	Trade
Kaemingk	Kaemingk is founded in 1937, as a company selling household products. Later on the focus changed to Christmas items. The main business process of Kaemingk is to sell Christmas items to a wide range of customers and when the products are sold, to purchase them and transport them to the customers.	Trade
Omron Healthcare	Omron Healthcare Europe is located in Hoofddorp (head office). The main products that are sold to consumers are body fat meters, 4-points Libra's, nebulizers and blood pressure monitors (70%).	Trade
Colbond	Located in Arnhem, is a global production leader of two types of chemical plastic products: *Industrial nonwovens* for flooring, automotive and construction applications and *3D polymeric structures* and composites for civil engineering, building and industrial applications.	Production

In the following table an overview is presented of the persons interviewed per company and their function in the company. What can be concluded from the table is that all interviewees are decision makers on the highest management level. This could be seen as a limitation of the case study, but one of the main goals of the research is to find out what impact strategy has on Performance Measurement and therefore participants had to be managers or employees of a comparable level. Another advantage of interviewing top management is that they generally have a good overview of the entire company.

TABLE 2: OVERVIEW OF INTERVIEWEES

Company	Name	Function
Burg Groep	Arjen Pauzenga	Finance Manager
	Heleen Dobber	Business controller
AudioNova	Stijn Bax	Chief Financial Officer
Kaemingk	Anne-Wiebe de Boer	Member of Board of Directors)
	Erik Oonk	Finance officer
Omron Healthcare	Dick Zonneveld	General Manager Operations
Colbond	Bart-Jan van Beckhoven	Information & Logisitics Manager

6.4 Interview set-up

The interviews had a dual focus: to establish the impact of a company's strategy on the view on Performance Measurement (which is more theoretical focus) and secondly to verify if the limited set of performance indicators (being more practical) was acceptable. In Appendix C.1, a list of the questions used during the interviews is presented. All interviews were conducted at the offices of the customers and lasted for 1,5 to 2,5 hours each. All interview notes are presented in Appendix C . The analysis of the interview results will be presented in the next chapter.

6.5 Summary

As part of the Master's project five companies were visited and interviews held with employees. This resulted in a set of interviews in which the different goals of the case study were checked.
The types of companies were a mixture of trade ventures and manufacturers. The interviewees were all employees of the top management of the participating companies. In the next chapter an extensive analysis of these interviews will be presented.

7 Data analysis: improving the design

7.1 Introduction

In this chapter the results of the interviews conducted at the five selected customers of Steltix will be reported extensively. In paragraph 0 the general findings derived from the interviews are presented in several subparagraphs. A link will be made next with corporate strategy as discussed earlier in the analysis of theoretical concepts. Then the differences between two types of companies (trade ventures vs. manufacturers) will be analyzed and a cross link with the literature study is made to finalize the literature cycle. And finally the results of the interviews are translated into improvements in the design of the OBI Connector / Performance Measurement framework.

7.2 General findings of interviews

In the next subparagraphs the outcome of the interviews is discussed in more detail. The general results are grouped together indicated by clear titles and will be linked to the theoretical concepts explained in chapter 3.

7.2.1 Formal Performance Measurement

An important discovery in the results of the interviews was that none of the participating companies had any formal Performance Measurement system in use. Of course all companies were using some sort of indicators or reporting tools to show them how the organization was performing, but most reports were formulated ad hoc on request of the management. The concept of a Balanced Scorecard is widely known, also by the interviewees, but they all acknowledged the limitations of the system, and its usability in particular. In the opinion of the interviewees the balanced scorecard is just a theoretical framework which showed that it is really necessary to focus on financial as well as non-financial measurements.

7.2.2 Operational excellence versus Management Excellence

The interview with the Oracle expert, Buytendijk (see paragraph 4.2), he claimed that the focus on Business Intelligence is gradually moving towards management excellence. The explanation for this phenomenon is that organizations have already widely improved their operational excellence. *Burg Groep* however indicated that major improvements can still be made in the field of operations. The assumption that organizations already excel in operations might not be correct. When operational processes include the entire supply chain of an organization (and not just the production processes), *Colbond* also stated that improvements can be made, especially at purchase processes level.

The outcome of several interviews showed that organizations can still improve their operational processes so it could be interesting to find out what the reasons are for the discrepancy between the ideas of the Oracle expert and the thoughts of the interviewees in the case studies. One of the main reasons for the difference in opinion could be the type of organization that is referred to. For example: it is probably impossible to further improve the operational processes of car manufacturers like Toyota. Companies like this have a long history, and have fine-tuned their operations over the years at the highest level of detail. Another example of a large company excelling in operations is Nike. As the production of shoes has been turned into an easy and efficient process, Nike has developed the

possibility to render additional services to their customers. With the introduction of the 'Nike ID' concept customers can now even choose their own colors to create unique shoes. However Toyota and Nike are much larger than the interviewed companies and have a longer history of improving their processes. But taking into account the history and size of organizations, all businesses should be able to further improve their operational excellence.

7.2.3 Definitions defined

Developing a list of key performance indicators took quite a long time, as the definition of each KPI should be very clearly marked. It was difficult to identify what is exactly meant by a specific KPI, because every interviewee had his own definition and mindset and this influenced the notion of an indicator. A good example of this phenomenon is the description of the indicator 'stock'. This indicator is used both for stock of finished goods as well as for stock of raw materials. It is clear that the notion of 'raw materials' is not applicable to trade ventures. The indicator 'stock' even caused more debate. For an organization like *AudioNova* this indicator is specifically important to identify so called 'free' stock items. This means that a specific item in stock is free to sell and not already claimed. *Colbond* on the other hand is not only interested in finished goods and raw materials, but also in work-in-process (WIP). This example of the use of the indicator 'stock' shows that when talking about Performance Measurement, it is very important to provide the user of a Performance Measurement system with a clear definition of what exactly is measured.

7.2.4 Garbage in, garbage out

The principle of 'garbage in, garbage out' is not a new concept, but it turned out to be a very important factor in every interview. Performance indicators are only useful if the underlying data are correct. In other words: translating data into management information only makes sense if the data are plausible. Employees generally know exactly how the organization is managed and what indicators are used for the assessment of performances and therefore may try to 'trick the system'. *Colbond* provided an example of quality management; while production employees noticed that a product did not fit the quality standards, they still moved it to the stock. Later on, when the item was sold, the sales department received a complaint from the customer about the quality of the product. The production quality indicator did not show any problems, whereas the quality was not always up to standard. After extensive investigation *Colbond* found out what the actual problem was. A good Performance Measurement solution should provide a solution to this problem.

7.2.5 Interest in Business Intelligence

In almost every interview the interest in Business Intelligence (which is according to the interviewees the same as Performance Measurement) turned out to be quite high. *Colbond* is the only company that has currently implemented a BI solution as a pilot project for both *Colbond* and Steltix. The other companies are also trying to measure performance but they all use different toolsets and lots of data sources. The results from the interviews showed that organizations are ready for and very interested in new advanced Performance Measurement tools. The main reason for this development is that they are keen to take the next step. When having implemented ERPs interviewees recognize the additional benefits that ERPs could have in Performance Measurement. *Burg Groep* indicated that they wanted to start using performance information to further improve operational processes. They also intend to use

the information to prove that assumptions about what is going wrong are actually correct. It is assumed that the capacity of the production lines is not being fully used and performance measures could prove this.

Another reason for the increasing interest in BI solutions is that companies have to generate reports, often to be composed ad hoc, which is a time consuming process. The directors of *Kaemingk* for example requested some information to be made available to them. The information had to be collected with the help of Microsoft Access and was then presented in a management report. Often these reports are the basis of and supply the motivation for new management questions and other important discussion making processes. A problem in extracting information is that the underlying data are stored in different information systems. The interviewees were all interested in a BI solution in which integration of these different systems is possible and fast and accurate answers to ad hoc management questions can be obtained.

7.2.6 Impact of laws & regulations

Measuring performance of individual employees in organizations turned out to be another issue of mutual interest of the interviewees. *Colbond* pointed out some difficulties concerning this matter. Laws and regulations have impact on some of the indicators measuring individual performance. What is or is not allowed to measure is strictly regulated by the government and these regulations are set in laws. However, in the first set-up of key performance indicators, only one indicator is related to measuring individual performance: 'orders processed per employee'. When this KPI is only used to measure the average number of orders per employee it is not conflicting with the regulations.

7.2.7 New performance indicators

Some interviewees came up with indicators that were not listed in the first set-up. They also provided some new ideas about Performance Measurement. In this paragraph these ideas will be illustrated.

- **Burg Groep**
  Portfolio analysis: being a production company it is interesting for Burg Groep to gain insight in a so called portfolio analysis. This analysis should contain information about the revenue of different products and product groups. When the information about the product portfolio is accurate and up-to-date, it can be used for production planning.
  Cash flow statements: the first set-up of the framework could be further improved by adding a functionality to gain insight in cash flow statements. Within this measurement snapshotting should be applied to see the development of cash flow over time.
- **AudioNova**
  Dimensional drill down: AudioNova possesses many different stores in various countries. Every store has got its own targets, depending on the accommodating country. When analyzing revenues it would be very helpful to be able to drill down from the total revenue to the revenue of the specific stores, and even to specific product categories. By comparing these indicators with the targets, management can easily analyze the performance. An outcome of this comparison could be that a specific store is selling too many low budget hearing aids or is offering too much discount to their customers.
- **Kaemingk**

Currency trading: Kaemingk is doing a lot of business in other countries with different currencies and therefore trading in currencies is essential. In any BI solution currency trading has to be one of the important indicators.

Human resources: the business of Kaemingk is very seasonally oriented, and therefore the company hires a lot of seasonal employees during a few months per year to assist with logistical processes. This cost driver is important and needs to be managed tightly. Insight in cost drivers, such as human resources, freight costs, temporary employees etc. would be very helpful.

General ledger: the management of Kaemingk indicated that insight in the behavior of general ledger accounts also is important.

- **Omron Healthcare**

  Ratios: Omron Healthcare mentioned that in the current set-up there are no balance sheet ratios available. Examples of these ratios are 'return on assets', 'fixed assets', 'taxation versus net profit', 'equities' etc. These figures are important business drivers and management would like to have an insight in these ratios.

- **Colbond**

  Comparable indicators: Colbond pointed out that some of the indicators influenced each other. An example is the quality of products and the lead time. These indicators are conflicting because a shorter lead time results in a lower quality of products. Therefore both indicators should be managed within some range and should be compared with each other. These KPI's have to be balanced. When employees are rewarded based on lead time only, they will pay less attention to the quality of the products (defensive routine).

  Dimension of time: in the current pilot project solution which was implemented at Colbond, the dimension of time is not available. This makes it impossible to compare indicators with results of the past. After having used their solution for some time now, Colbond concluded that time is a necessary feature that has to be included.

  Inventory health: the products of Colbond have to meet specific quality requirements. A comprehensive quality management system defines a quality grade for every lot. Besides the quantity and value of the inventory, it is also important to know what the quality of the inventory is (inventory health). This information is used for example by sales people to define the selling price of a lot.

7.3 Critical success factors

In this paragraph some critical success factors of a Performance Measurement / Business Intelligence tool will be explained. These factors are all derived from the results of the interviews.

- **User friendly and intuitive interface**

  All interviewees indicated that any Business Intelligence tool should be user friendly. Almost all companies use Microsoft Office (Excel and Access) to generate management reports. One of the reasons for using Office is that there is no other system available. It is however more likely that Office is used because of its user-friendliness. Employees are used to working with Excel and know how to customize reports.

- **Performance must be excellent**

Enterprise Resource Planning systems generally are heavy information systems that consume lots of technical resources. All the interviewees indicated that any Business Intelligence tool should not have any impact on the performance of the ERPs. The interviewees were a little bit worried about this aspect, so the use of a data warehouse is inevitable. The transfer of source data to the warehouse should be done during the night (when the ERPs are not or less being used). By doing so the effects on performance can be minimized.

- **Dimensions**
  The aspect of dimensions turned out to be a very important feature of the Business Intelligence tool. In the first set-up the dimension of time was already implemented. But other dimensions proved to be equally important. The interviewees not only wanted to be able to compare performance indicators with results achieved in the past, but also with set targets. These targets can be market forecasts or budgets. And, as discussed earlier, it should be possible to drill down into a specific indicator.

7.4 Linking corporate strategy

In this paragraph the common corporate strategies as discussed in paragraph 3.8.5.2 are linked to the results of the case studies. The differences in opinion regarding Performance Measurement and Business Intelligence will also be explained.

7.4.1 Different strategies and preferences in performance indicators

- **Cost leadership strategy**
  From the participating companies, Burg Groep can be classified as a company having implemented the cost leadership strategy. The aim of the Burg Groep is to produce vinegars for the lowest possible price. Some parts of the strategy of differentiation are also implemented as Burg Groep is the only company (compared to competitors in the same market) that can easily switch their production line to fill the products in different packaging's and sizes (plastics, glass).

- **Differentiation strategy**
  Kaemingk can be classified as a differentiator; the company tries to differentiate their range of products while the target customers are not segmented. No special products exist for special customer groups. The only differentiation into segments is based on the purchasing conditions, but this is not based on segments but on purchasing volumes.

  Colbond also has adopted the differentiation strategy. With their specific chemical products *Industrial nonwovens* for flooring, automotive and construction applications and *3D polymeric structures* they are one of the market leaders. They try to differentiate by adopting high quality standards and supply chain improvements.

  AudioNova sells hearing aids, primarily meant for elder people. The average age of their customers is around 74 years. The group of elderly people with hearing problems is the market for AudioNova. One of the effects is that in this market, marketing is not very elaborately

developed. AudioNova tries to differentiate their assortment and the delivery of high service. In the Netherlands, the health insurers allow their customers to buy a new hearing aid every five years. By delivering high service, AudioNova tries to attract and hold their customers.

- **Segmentation strategy**
  From the participating companies in this project, Omron Healthcare can be classified as a company that has adopted the segmentation strategy. The products of Omron Healthcare are healthcare products for the consumer market, such as nebulizers, body fat meters etc. So the focus is on customers / consumers who are aware of their health and who want or need to use the instruments produced by Omron.

In Table 3, an overview of the preferences for specific indicators, or functional domains, is given. Independent from a specific strategy is a high interest in balance ratios by all participating companies. This notion is used to further improve the design (paragraph 7.5). Another independent indicator is 'sales volume'. Every participating company showed interest in this indicator. It seems that every organization understands the value of insight in this indicator. The most important difference between the strategies is that the cost leadership strategy showed lots of interest in operational (production) indicators. Burg Groep indicated that probably lots of improvements (cost reduction, efficiency) could be established in the production cycle. Both other strategies showed interest in quality management. The companies want to improve 'customer intimacy' in another way. The cost leaders want to bind the customers with the low prices and differentiators and segmentation companies want to bind the customers with quality of the products.

TABLE 3: STRATEGY AND INDICATOR PREFERENCES

Porter's Strategy	Preferences of indicators	Companies
Cost leadership	(gross) margins production cycle time operational indicators	Burg Groep
Differentiation	costs and productivity of human resources quality management logistics service levels customer satisfaction purchasing prices	Kaemingk Colbond AudioNova
Segmentation	quality management inventory management	Omron Healthcare
Independent of strategy	**Balance ratios, sales volume**	**All**

7.4.2 The matrix

During the interviews the model with the six functional domains was shown to the interviewees. They all approved the six functional domains, and indicated that all necessary indicators could be classified within these domains. This was sufficient as verification and validation of the domains and these could

then be used in the further development of the tool. Kaemingk came up with another 'need to have' for the system. The management, consisting of two people, does not appreciate the fact that all employees have access to the indicators. To be able to give selective permission to employees to use the Performance Measurement tool should be incorporated. Instead of managing permissions by functional domains, the permissions should be managed at management level. For example: the two directors have to have permission to access all strategic indicators and every drill down possible. The finance manager should only get permission for finance related indicators at tactical level and operational employees only need to see indicators that can help them in their work. Operational employees should not have insight in, for example, balance sheet related indicators as this is simply not directly related to their business. This comment subsequently led to a new model of presentation which is shown in Figure 17.

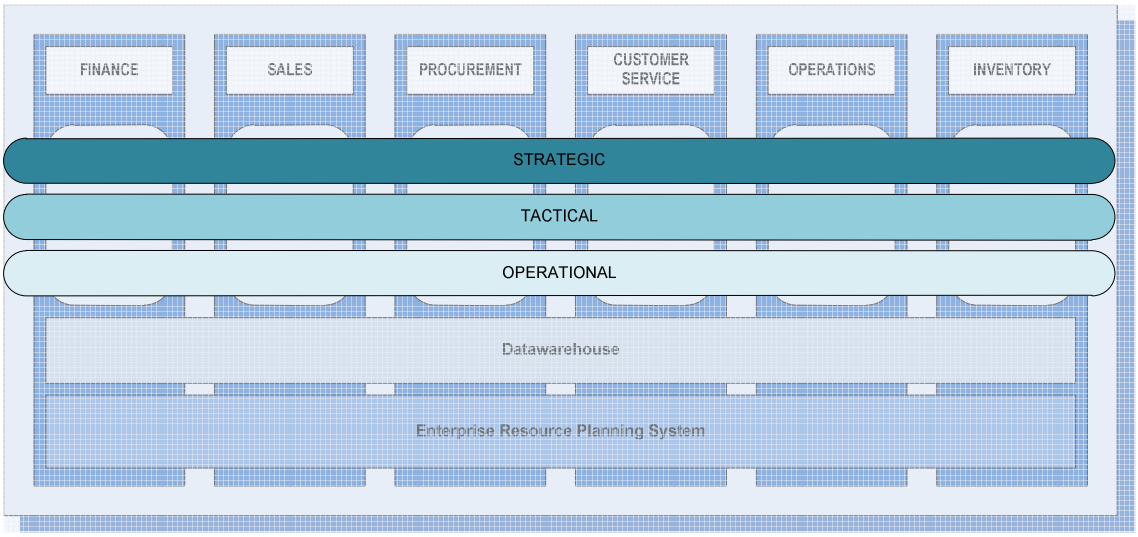

Figure 17: Changes in framework: three levels of management added

7.4.3 Trade ventures versus Production companies

Beside differences in corporate strategy, the organizations can be classified in two categories: trade ventures and production companies. The differences between trade ventures and production companies are obvious. Production companies allocate added value to any Business Intelligence tool because it can help to improve the production process. This can save costs and time. Trade ventures on the other hand are more interested in any indicators that are related to money. Production companies are interested in performance indicators in all three categories: strategic, tactical and operational indicators. The trade ventures have a strong focus on indicators at strategic level to support the management of the company. A possible explanation for this fact could be that generally speaking the management level in trading companies is smaller than in production companies. So, management at a higher level is more interested in financial indicators.

7.5 Improving the design

The analysis of the case studies described in the previous paragraphs resulted in improvements of the Business Intelligence tool.

7.5.1 Balanced KPI's

An important outcome of the interviews is that Performance Measurement systems which are related to rewarding systems often result in defensive routines of employees. This also is an important notion for the use of Performance Measurement systems. These results were used to improve the design of the tool. The design of the Business Intelligence tool was therefore complemented with *balanced KPI's*. This meant that for every indicator that can be directly influenced by employees, a controlling indicator had to be added. An example of two balanced KPI's is 'production lead time' and 'quality'. Based on the strategy, the organization has to decide how to balance the KPI's.

Balanced KPI
A balanced KPI is a set of performance indicators which directly or indirectly influences each other. The individual indicators should be managed to be able to make statements about performance (Mink, 2009).

It can be difficult to predict on beforehand which indicators should be balanced to gain sufficient information to manage the organization. It is conceivable that the balanced KPI's are noticed after the Performance Measurement has been adopted. The Performance Measurement system therefore should be capable of adding new indicators in an easy way.

7.5.2 Causal relations

To gain valuable insight in the performance of an organization, it would be most helpful to see how all indicators are related and to see what the results of a change of an indicator value is. This is made visible with the aid of one or more causal relationship diagrams. These diagrams have to be available to the users of the Business Intelligence tool. Causal relation diagrams can help employees in understanding the importance of performance indicators.

Another point for improvement is the addition of balance sheet ratios to the list of indicators. When some of the performance indicators listed in the first set-up and new ratios are combined into a causal relationship diagram, the result looks like a DuPont scheme. A DuPont scheme relates some ratios (such as return on assets) to the source numbers (such as sales volume). In Appendix D a solution of a causal relationship diagram is presented.

8 Conclusions & Recommendations

In this final chapter the research questions will be answered based on the results from the literature study, the development of the first set-up of the framework, the interviews conducted with employees of various companies and the further improvements of the design of the tool. The main findings of the project will be described in paragraph 8.1. Then a reflection on the main research questions as stated in paragraph 1.4 will be presented and finally, some limitations of this research and recommendations for further research are going to be explained.

8.1 Main findings

The case study resulted in some main findings about Performance Measurement in relation to ERPs. The most important results will be described.

- Companies are still trying to further improve of their business processes. This means that a Performance Measurement / Business Intelligence tool would be primarily used within a company to create operational excellence. The question that has to be answered is 'are we doing things right?' A next step would then be that companies are going to use management information to improve strategic business decisions to be able to finally answer the question 'are we doing the right things?'

- Differences between trade ventures and production companies, organizations interviewed for this project, primarily show an interest in different performance indicators. Trade ventures are basically more interested in finance related indicators while production companies recognize the benefits of Performance Measurement for operational process improvement.

- When developing a Performance Measurement tool it is important to understand that certain success factors exist. The most important one is the user friendliness and the clarity of such a tool. Otherwise the users will continue using their own programs such as Excel or Access to generate management reports. The performance measures should furthermore be presented in a logical way within a matrix structure. The measurements (key performance indicators - KPI) have to be subdivided not only into functional domains but also into strategic, tactical and operational measures.

- Balanced key performance indicators had to be introduced, for two reasons. When employees are rewarded based on performance indicators, they adopt defensive routines to improve the performance of a specific indicator. Introducing different indicators could give a more balanced view on the performance figures. The second reason for introducing balanced KPI's is that indicators can be conflicting with each other. Based on the strategy of a company, the optimum amount and types of indicators have to be defined. In other words: it is not always possible to just maximize indicators.

- The use of dimensions also proved to be important. In the situations examined in this study not only the dimension of time was useful to add to the list of indicators but also the possibility to add forecasts or budgets in order to be able to compare the actual measures with results achieved in the past and to check if set targets were achieved.

- All companies were interested in balance sheet related performance indicators, particularly the trade ventures. These ratios should be presented in a structured way to easily understand what the meaning of a specific ratio is. The main mentioned ratios were return on assets and return on equity.

8.2 Thesis conclusions

In the next paragraphs a reflection on the research conducted for this Master's thesis will be elaborated. The answers to the three main research questions are discussed in the following three paragraphs.

8.2.1 How can ERPs successfully add value to organizations by providing more effective Performance Measurement?

The first conclusion that can be drawn is that organizations have no or very limited Performance Measurement solutions in operation. One important reason for this phenomenon is that organizations have great difficulties to combine different data sources into workable management reports. The standard reporting functions of Oracle JD Edwards and probably other ERPs as well, are not efficient enough to be applied for this purpose. The massive volume and the complexity of ERPs make it difficult for organizations to use these systems for other purposes than just storing process data. However, the ERPs contain the most vital business process data of the organizations participating in this project and therefore could be of enormous help. A standardized Business Intelligence tool can assist organizations and serve as a starting point for the further development of a state-of-the-art Performance Measurement system. Such a standard solution, as being currently developed by Steltix, could implicate around 80% of all useful key performance indicators. These indicators are often not unique and similar for most organizations. For instance all organizations wanted to gain insight in 'Sales Volume'. By extracting the source data of the ERPs and putting these into a stand-alone data warehouse, organizations create the possibility to add other data sources in a later stage.

8.2.2 In what way should strategy be used in Performance Measurement?

The set of performance indicators that can be defined for organizations is almost unlimited. In the standard solution, as was developed, around 40 key performance indicators were defined. It is however impossible to manage an organization on that many performance indicators. At the various levels (strategic, tactical and operational), only a limited set of indicators should be incorporated to be utilized for the management of the company. So organizations must make a selection of measures to be used. This selection depends highly on the company's strategy. A cost leader for instance is more interested in reducing productions cost (by reducing purchase costs or reducing waste) than the quality of the products. Whereas the primary focus of companies with a strategy of differentiation or segmentation will on the contrary be more on quality.

The organization's strategy also has a great effect in the case of performance indicators conflicting with each other. An example of this phenomenon can be illustrated with the indicators 'production cycle time' and 'quality of products'. These indicators could create conflicting situations. Based on their strategy an organization has to decide how to balance these conflicting indicators.

8.2.3 How can these aspects result in a framework to improve Performance Measurement in organizations?

Organizations wanting to improve their Performance Measurement systems often do not know where to start. By providing organizations with a standardized solution, already including many of the organization's independent performance indicators, Performance Measurement could be improved tremendously. However, it is important to state that such a standardized solution could only be used as a starting point for the further development of Performance Measurement. Based on preferences resulting from the strategy of an organization, the Performance Measurement system should be complemented with specific key performance indicators. The framework that was developed is described in detail in chapters 5 and 7.

8.3 Limitations of research

The research presented in this thesis had some limitations that will be acknowledged hereafter.

- **Number of interviews**
  For the case study six companies were visited and interviews were held with employees. One of these interviews was unfortunately less useful (because the interviewee was not eager to tell anything about Performance Measurement), but the remaining interviews provided many new insights and thoughts about Performance Measurement. The research could have been more valuable when validation had taken place by conducting more interviews. Statements about the differences between trade ventures and production companies for example would have been more reliable when they were based on more interviews. Also company classifications could have been made more valuable (such as the exact size of a company). Due to limitations of time and resources the study had to be restricted.
- **Interviewees all top management**
  All the interviewees were members of the top management of the specific companies. Therefore the conclusions in this research report mainly originated from the top management perspective and could present a somewhat one-sided picture of the reality. To gain a more balanced view on Performance Measurement, employees of other companies and of another level in the organization have to be interviewed as well.
- **Limitations of Oracle**
  The participating companies were all using Oracle JD Edwards as ERP system. The possibility that the type of ERPs used had impact on the opinion of people regarding Performance Measurement could therefore not be excluded. The results would be more valuable when users of other ERP systems could also have participated. That makes it possible to make a comparison. This limitation was caused by the fact that the research of this Master's project was conducted at Steltix, a fixed Oracle JD Edwards implementer.
- **Improvements not validated**

The improvements made to the initial design were not validated by the interviewees. So it cannot with certainty be concluded that the solutions chosen were adequate for the participating companies. However, the input given by the companies and the results from this research are going to be used by Steltix for the further development of a Business Intelligence tool that might be used in the future by the same companies.

- **People aspects not included**
  When looking at the performance of organizations the aspect of human behavior could also be an important factor. This aspect is however not included in this research as it did not fit the scope of the study. When performance is being measured, the outcome of the management information should be translated into changes in people's behavior in order to improve the performance. This process has not been researched in this project.

8.4 Recommendations for future research

This research confirmed that a lot of interest exists for Performance Measurement and Business Intelligence. Not all aspects of this phenomenon have been investigated and therefore recommendations for further research could be mentioned. These recommendations are partly derived from the limitations as discussed in the previous paragraph.

- **Compare a larger group of companies**
  In future research, to make results more sustainable, a larger set of companies could be involved in the research. And within every company, people from different management levels should be involved.
- **Benchmarking**
  Benchmarking would be a very interesting topic for further research on Performance Measurement. As discussed in this thesis, Performance Management can be approached from two perspectives: operational excellence and management excellence. To discover if a company is performing well, it is practical to be able to compare actual measurements with results achieved in the past, as it is also important to compare measures with set targets. These targets are set by the top management and are based on developments of the market. An interesting feature of Performance Measurement tools could therefore be benchmarking. By combining the measurements of similar companies, those measures could be easily compared. To what extent and in what way benchmarking would be possible to integrate in the tool will be interesting as a topic for future research.
- **Differences between larger and smaller companies**
  Revealing differences between larger and smaller companies regarding Performance Measurement could be another interesting topic for further research. 'What impact does the size of a company have on the thoughts and interest for Performance Measurement?' would be an appropriate research question. This could be combined with an elaborate research including more participators from different levels in the companies.
- **People behavior versus Performance Measurement**
  Another recommendation would be to involve some social sciences in the research. This should focus on the behavior of people within a company when a Performance Measurement system

has been implemented. How does the behavior of people change when they understand on which indicators they are rewarded?

List of figures

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Appendix A Interview with Oracle expert

Appendix A.1 General information

Interviewee: Frank Buytendijk
Subject: An interview about the aspects of ERPs, Business Intelligence & Performance Management
Date: 26-08-2009
Location: Utrecht, Restaurant Griftpark

Appendix A.2 Background interviewee

20 years' experience in Business Intelligence, first it was EIS: Enterprise Information Systems

- Gartner
- Hyperion
- Oracle – Vice President Enterprise Performance Management, responsible for 'thought leadership'

Appendix A.3 Unstructured interview notes

Thought leadership – looking one step further, from outside in. It is not the search for best practices, but next practices (futures best practices)

ERP and BI history

ERP and BI are terms which are converging.
In 1997 or 1998 there was a congress in the UK with ERP and BI as topic. The interest in this congress was too low, so it was cancelled. Three years later the topic received more and more attention.

First organizations were competing on 'operational excellence'.
Operational excellence on three main parts:

- Cost
- Quality
- Time

ERPs helped organizations a lot with this.

But it is more and more difficult to make the difference on operational excellence. The question "where to compete?" arises.

Next step: Management excellence:

- Being Smart
- Being Agile
- Being aligned (horizontal alignment)

Three (possible) drivers for ERP implementations

- System consolidation

Replacing used applications/systems
    - Trigger 1: millennium issue
    - Trigger 2: implementation of euro as currency standard
    - Trigger 3: IFRS, new accounting standards
- Effectiveness
  Realize and establish new and better processes, with possibility to use standard processes.
- Transformational
  When changing the complete business model

BI successful because after ERP adoption the data is accessible more easily. Before ERP adoption, the needed data has to be inserted from other systems, which was a resource consuming process.

Standard ERP processes => standard BI processes

ERP makes BI possible from department to whole organization…

Performance Measurement: BI by means, operating excellence the goal?

BI: Key to process improvement is information. And BI makes it possible to gain insight in the real demand in the supply chain (bullwhip effect).

Why Business Intelligence?

1) We are ready for it
2) Political: Forced transparency
3) Economical: cost control, margins under pressure due to globalization
4) Social: stakeholders are much interested in the background of the company. (employees wants to know if their employer is green enough)
5) Employees are collaborative themselves: if information is not available, they are using their own systems to share more information.
6) Technical: information (or data) growth is enormous. Therefore, BI can help to organize this information.
7) Business: information is the competing service, the only exceeding value. (example of car lease companies)
8) Investors: before they only want the numbers, now they want to know more about the strategy, corporate governance, board members etc.

Three reasons why BI (partly) caused the credit crunch

1) KPI's connected to bonus and rewards
   Without connect rewards to risk.
2) Risk profile not checked (BI: advanced analytics, too complex)
   Banks bought packets of mortgages, they re-organized the packages and sold them. But that has nothing to do with the core business of banks. Pyramid game… ("gebakken lucht")
3) BI: compliance reporting (afvinken en we zijn er)
   Compliance reporting means that organizations just did only what they had to do. By "checking the list" and not looking further.

But BI is also the solution: by giving real and correct insight in figures.

US: rule oriented (Sarbanes-Oxley)
Europe: principle oriented
S-O is limiting companies; they don't want to know everything what is possible to know, because companies have to publish all known information. So companies don't want to know everything that could help by managing the organization.

References of Buytendijk

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- Don Tapscoot – The naked corporation
- Thomas H. Davenport – Competing on Analytics
- Bemelmans – Besturingsparadigma
- Mintzberg – Managing
- Buytendijk – Performance Leadership
- Theory of constraints

Appendix B Initial list of key performance indicators

TABLE 4: THE INITIAL LIST OF KPI'S WITH THEIR CLEAR DEFINITIONS

Functional Domain	Metric	Explicit definition This KPI...
Customer service	% of product returns	gives the number of credit invoices in the last month
Customer service	Customer profitability	gives the average profit per active customer
Customer service	Customers lost	gives proportion of customers that haven't placed any order in the last month to customers that have
Customer service	Lead time from order to delivery	gives the average time between order date and the actual delivery date (so this metric is per order)
Customer service	New customers	gives percentage of new customers in relation to the total number of customers
Customer service	Order Delivery on time (DIFOT)	gives the percentage of orders (without proposals) that are delivered on time
Finance	(Gross) Revenue	gives the revenue in the last month (sum of all invoice amounts)
Finance	(Gross) Revenue growth	indicates the revenue of the last month in comparison with the revenue in the same month a year ago.
Finance	(Gross) Revenue per customer	gives the average revenue per active customer in the last month
Finance	(Gross) Revenue per order	gives the average revenue per order in the last month

Finance	Accounts Payable	gives the total amount to be paid (outstanding creditors)
Finance	Accounts Receivable	gives the total amount to be received (outstanding debtors)
Finance	Costs per customer	gives average cost of goods sold per active customer
Finance	Costs per order	gives average cost of goods sold per order
Finance	Days sales outstanding (DSO)	A low DSO number means that it takes a company fewer days to collect its accounts receivable. A high DSO number shows that a company is selling its product to customers on credit and taking longer to collect money.
Finance	Distribution cost per order	gives the average distribution cost per order
Finance	Overhead cost per order	gives all not invoiced costs, which therefore result in the overhead cost per order
Finance	Overhead cost per customer	gives all not invoiced costs, which therefore result in the overhead cost per customer
Finance	Overhead costs	gives all overhead costs spent in the last month
Finance	Profit	gives the profit per client & clientgroup and per product & productgroup
Inventory	Inventory turnover	gives the turnover of the inventory: how often is the inventory volume sold
Inventory	Number of backorders	gives the number of backorders
Inventory	Stock items reaching Best Before date	gives the percentage of items in stock that are reaching their Best Before date

Inventory	Stock of finished products	gives the total number of stock items (per product)
Inventory	Stock of raw materials	gives the total number of raw materials in stock
Operations	Loss ratio of material per product	Gives the loss of material in the production process per product
Operations	Manufacturing cycle time	gives the average production cycle time for a product
Operations	Orders processed per employee	gives the number of orders that are processed per day per employee
Procurement	Purchases per supplier	gives the product costs per supplier
Procurement	Purchase costs per order	gives the overhead purchase costs per purchase order
Procurement	Purchase order costs	gives the additional costs per purchase order (such as distribution costs)
Procurement	Purchase order delivery on time (DIFOT)	gives the percentage of purchase orders (without proposals) that are delivered on time per supplier, total and per productgroup
Procurement	Value of purchase orders	gives the total amount of placed purchase orders in the last month
Sales	(Gross) realized by new products	gives the percentage of sales volume that is realized by selling new products
Sales	(Gross) Sales Volume	gives the sales volume of all invoiced products in the last month
Sales	(Gross) Sales by new customers	gives percentage of sales volume generated by new customers

Sales	(Gross) Sales growth	indicates the sales volume of the last month in comparison with the sales volume in the same month a year ago
Sales	(Gross) Sales Volume per customer	gives the average sales volume per active customer

Appendix C Interviews

Appendix C.1 Set-up of interviews

List of questions

Introduction

- Short introduction
- What is your organizations' business?
- What is your role in your organization?

Current situation

- In which way is your organization managed at this moment (which parameters are used)?
- Is this sufficient?
- Are there any formal procedures about this? For example: a Performance Manager, a BI manager etc.
- Are there any KPI's used at this moment?
  - At all management levels? (Strategic, Tactical and Operational)
  - Are there any relations between these KPI's?
  - Are these KPI's really used as management information. In other words: is your organization managed by input of the KPI's?
- Does your organizations' strategy have any influence on the development of these KPI's?
- Can you shortly describe the strategy of your organization?
  (Cost leadership, customer intimacy, product leadership [Wiersema])
  (Cost leadership, differentiation, segmentation [Porter])
- If Performance Measurement / BI play any role in your organization, can you describe what the main purpose of this is? For operational or management excellence. In other words: to improve (production) processes or to improve the position in the market?
- Which functional domains are interesting for your company?
  - Finances
  - Sales
  - Customer service
  - Operations
  - Inventory
  - Procurement
- Are there any functional domains missing?

Point of improvement

- Which need for improvement of Performance Measurement exist in your organization?
- Is this need intended by strategy (top-down) or by the existence of information (bottom-up)?
- Does this need exist on every level: strategic, tactical, operational?

Perspectives of the future

Appendix C.2 Burg Groep

Appendix C.2.1 General information

Contacts

Arjen Pauzenga, Finance Manager at Burg Groep

As Finance Manager Arjen Pauzenga is responsible for all finance related business information. Therefore he is involved in the implementation of Oracle JD Edwards and has extensive knowledge (already) on the topic of Business Intelligence.

Helen Dobber, Business Controller at Burg Groep

As business controller Helen Dobber has to create business reports and present financial figures to higher management.

Type of company

Burg Groep is a large producer of vinegar & syrups and is located in the Netherlands with offices in different countries in Europe. Headquarter is in Heerhugowaard. The products can be delivered in different packaging's, from bulk to small glass or plastic bottles.

Short description

Manufacturer in food & beverage industry

Appendix C.2.2 Interview

What aspects are being used to manage the company at this moment?

Different tools have been implemented to supply management with the right information to run the company. Cognos PowerSuite, Business Objects and GL Inquiry Suite are used or have been used in the past.

Data are stored in a Microsoft SQL Server and in combination with Excel, many instant reports are created. The biggest advantage in the opinion of the interviewees is that Excel is very recognizable for the end-users. It therefore adds lots of value to the business. One big disadvantage of Excel is that it paves the way to a derogatory interpretation of the numbers presented.

At this moment the users of the information are mostly financial and commercial business people. The need for information is gradually increasing at the shop floor (operations).

Are these aspects satisfactory?

Gradually the need for operational information is growing. Information about production lines, such as production cycle time, machine occupancy etc. is needed at the shop floor.

The first impression of Oracle BI is that it is quite unwieldy in comparison to highly flexible tools as Microsoft Access or Excel. Software tested or used recently was not satisfactory.

Formal procedures for Performance Management / BI?

Within Burg Groep

Appendix C.2.3 Key Performance indicators (KPI's)

Are KPI's being used?

Interested stakeholders are financial and commercial employees. The financial employees use Excel to generate standard financial KPI's such as (gross) revenue, costs, profit etc. However, the need for performance indicators at operational level is increasing.

On which level? (strategic, tactical and/or operational)

In particular at strategic (top management) level. There is a growing need for performance indicators that are related to production at operational level.

Appendix C.2.4 Corporate strategy

How could the strategy of the company be defined?

In terms developed by Porter or Treacy / Wiersema the strategy of Burg Groep can be defined as cost leadership. Burg Groep aims to produce as many products as possible at the lowest price. An advantage with respect to their competitors is that Burg Groep is able to fill products into packagings of different materials, in particular glass as well as plastic bottles, and in different sizes. Customers are placing new orders because Burg Groep is capable of delivering on time, being cheaper and being able to distribute their products in different packagings . Contracts with their customers are long-term (mostly).

The type of orders is a mixture of 'make to order' (MTO) and 'make to stock' (MTS). The sales forecast in this perspective is important. Most orders from retailers are MTS and for example large orders from countries like India are MTO.

How does this strategy influence the determination of KPI's?

The fact that Burg wants to be a cost leader in the market influences the interest in performance indications in such a way that there is a need for information related to reducing costs and increasing production cycle time. An assumption made by the interviewee is that most business improvements can be obtained in the production cycle (operations). It is estimated for example that some machines only operate at 60% of their capacity.

Delivery in full on time (difot) is an important performance indicator because when the DIFOT value is too low, the company has a major problem with some of the customers. As most customers are contracted in the long-term, the effects are not immediately visible, but will eventually result in a weaker position in future contract negotiations.

Cost management

Fixed costs are not assigned to products or activities, but just accepted as fixed costs. According to the interviewees, most benefits can be achieved in reducing variable costs. At the end, the gross margin of a bottle is one of the most important performance indicators. It is in any case the most important figure to run the organization.

Revenue
Variable costs –
Gross margin
Fixed costs –

Result

From a financial perspective a lot of KPI's related to the balance sheet are interesting for the management. Figures as can be found in Dupont (nice to have) schemes, e.g. company solvency, return on equity, return on investment etc.

Interesting point from a financial perspective is to gain insight in payment discounts. Financial figures should also be available in some kind of a trend analysis.

Appendix C.2.5 Points of Improvements

What are the needs (points of improvement) for Performance Management / BI?

At this moment a tailor-made solution has been created. The result is a Microsoft Access database providing management information. The data from this database are sometimes exported to Excel to create customized reports. This is a time-consuming process that could be done in a more efficient way (for example with a good BI solution).

The ERPs in combination with a good BI solution should be able to help in forecasting results. These forecasts could improve management of the production process and the management of inventory.

Another purpose of Performance Management could be to balance seasonal patterns in production capacity. What effect do these patterns have on inventory and efficiency? (manufacturing resource planning, MRP)

When KPI's are related to dimension of time (history), it would be helpful to set the frequency of the snapshot process.

From procurement perspective the purchase prices per product (or raw materials) are interesting (sorted per category code) because the changes in purchase prices influence the gross margins (cost price of goods) a lot. In this matter both volume effects as well as price effects are important for the management.

The costs of purchases of raw materials as well as finished goods are also interesting to value the current inventory.

Finally, also some reports could be helpful to account managers. Much information is already known to them, but they don't have the tools to prove their assumptions right.

Does this need come from a top-down or a bottom-up approach?

From the Strategic-Tactical-Operational perspective, the need for a BI tool comes from / originates from a bottom-up approach. But from an ERP perspective, the need for a management tool is top-down driven.

On what management level does the need for a BI tool exist?

As mentioned before there is a need for more operational KPI's. It is expected that operational processes could be improved a lot. The need for this kind of KPI's is intended for the strategy level as top

management likes to gain insight in what the bottlenecks in the business processes are. These bottlenecks restrict the (gross) margin, which is an important management indicator. Assumptions are being made by management, but the fundaments are missing to take conscious business decisions.

A need for good management information exists also at higher levels. It is for example interesting to know what customers are responsible for which part of the revenue, but also what products are responsible for the revenue (portfolio analysis).

What could be critical success factors (CSF's)?

Some CSF's are:

- Ability to build standard reports
- Different dimensions (KPI's related to history but also related to budgets)
- Performance
- User-friendly (e.g. Excel is very customizable and easy to use)
- Ability to connect other sources to data warehouse in the future

Appendix C.3 AudioNova

Appendix C.3.1 General information

Interviewee

Stijn Bax – Chief Financial Officer since 1-1-2008 and previously at one of the branches (Schoonenberg Hoorcomfort); he is responsible for all finances of the AudioNova group and also for the financial consolidation of all different countries.

Type of company

AudioNova is one of the largest suppliers of hearing aids in the Netherlands and also has noteworthy market shares with different brand names in other countries (8 in total). These countries are the Netherlands, France, Germany, Italy, Belgium, Portugal and Denmark.

The Dutch headquarter, located in Rotterdam has four main tasks:

1) Coordinating purchases
   When contracts are drawn up, the fulfillment of the contracts is done locally.
2) ICT
   There is one datacenter and one Front Office software tool (Noveo, originally a German software package adapted to fit the AudioNova group perfectly)
   Back-office consists of ERP, Oracle JD Edwards
   First line support is carried out to local countries, second line support is centrally organized from the Rotterdam offices.
3) Business Development
   Find new markets to entry (= new countries)
4) Finance & Controlling
   Consolidation of different countries and reporting.

Appendix C.3.2 Interview

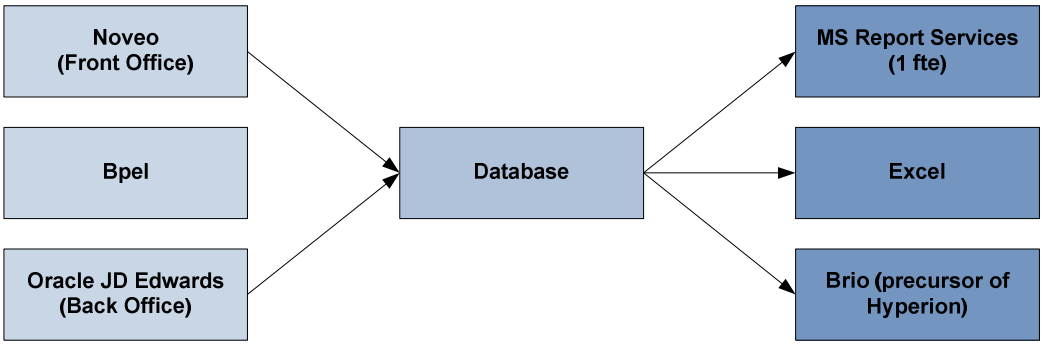
Formal procedures for Performance Management / BI?

Oracle JD Edwards is being used company wide. The billing takes place in the local shops and afterwards these data are imported into Oracle JDE.
Sales orders are registered in the front office tool Noveo. This information is important to manage the shops.

Oracle JD Edwards is also used to organize logistics (order management). The central warehouse will be closed down in the near future. The character of the company will become more decentralized.

The status of the current inventory was sometimes not clear. The front office tool Noveo has ensured that more insight is gained. The question rises why Oracle JDE should be used for this purpose.

The next figure shows how Performance Management is organized at AudiaNova. A problem existed in translating table names / titles of the central database. These table names were translated literally.



Appendix C.3.3 Corporate strategy

How could the strategy of the company be defined?

Company growth can be reached in two different ways: 1) increase market share in a specific market (country) and 2) enter new markets (in new countries) by takeovers of competitors.

Another key characteristic of the strategy is the "share & learn" principle to improve and standardize business processes. The sharing part is easier than the learn part. Learn from each other sometimes is difficult because of the differences between the countries, both in informal (cultural) and formal matters. For example: in the Netherlands, hearing aids are sold in shops, but in Italy you can only get hearing aids in specialized clinics. In Italy, the audio-specialists are educated at a university, in the Netherlands it is a less prestigious job.

The average selling price of a hearing aid is 1000 euro. About 480 euro is reimbursed by the health insurance in the Netherlands. The cheapest hearing aid costs around 480 euro (obviously) and the most expensive one costs around 1800 euro. There are differences between countries, for example in Denmark where the company acts as a discounter.

The process of selling a hearing aid to a customer consists of three appointments:

1) Intake appointment (45 min)
2) Fitting (45 min)
3) 3 control appointments (30 min each)

The customers of AudioNova are elderly people (average age about 75 years). In the Netherlands: customer intimacy is important (be reliable and trustworthy). "Value for money". The price is less important because a big part of the price is reimbursed by the insurance company. Positioning the brand is different in each country: the added value for margins is the final goal.

Appendix C.3.4 Points of Improvements

What are the needs (points of improvement) for Performance Management / BI?

Interesting performance indicators are mostly commercial driven like:

- Volumes
- Hearing aid sold with or without service contract
- Number of appointments

- Occupancy of audio-specialists (relating to targets)

There is a need for ad hoc queries, because current standard reports are too limited. These ad hoc questions originate from the business lines.

Reporting is a weak point of Oracle JD Edwards. Financial information should be real-time information and therefore derived directly from Oracle JD Edwards. Other information is not necessary to be real-time.

Appendix C.4 Kaemingk

Appendix C.4.1 General information

Interviewees

Anne-Wiebe de Boer, he is one of the two board members of Kaemingk.
Erik Oonk, is responsible for Finance and IT within Kaemingk.

Type of company

Kaemingk was founded in 1937, as a company selling household products. Later on the focus shifted to Christmas items. The main business process of Kaemingk is to sell Christmas items to a wide range of customers and when the products are sold, to purchase them and transport them to the customers. So it is typically a trade venture.

The company is located in the eastern part of the Netherlands, in the small village of Aalten. The company employs 250 people and another 75 people are seasonal workers. The 250 persons are divided into 175 logistics oriented personnel and 75 staff at the office desks.

Appendix C.4.2 Interview

Formal procedures for Performance Management / BI?

Currently, Microsoft Access is used to create ad hoc reports. The main source for Access is Oracle JD Edwards.

Appendix C.4.3 Key Performance indicators

Are KPI's being used?

Specific KPI's that are used and interesting are:
Purchases
Account Receivables
Budget temporary workers
Liquidity
Inventory
Cash flow => derived
This kind of indicators is leading for the business.

The indicators are compared with the same indicators in the past (the previous year). Comparison with the past (history) is only effective when the scope is one year because of the seasonal characteristic of the business. When indicators are not satisfactory, the management will investigate the matter deeper to find out what is wrong.

Ad hoc report requests are created by Erik. These ad hoc requests arise from the presented ratios or are just new questions.

Important for the business is also the currency trading. As a lot of business is done in other countries, the US dollar is important.

Most reports are currently generated with the help of Microsoft Access. The main data source for Access is Oracle JD Edwards.

At what level? (strategic, tactical, operational)

Because the directors are acting closely together in the operation of the company, almost all requests for performance indicators or Business Intelligence reports come from them. Many figures should definitely not be available to operational employees (for example balance sheet figures). Another positive effect of acting so closely in operations is the fact that sometimes information has already reached the directors even before it is presented in reports. For example any delays in deliveries.

Appendix C.4.4 Corporate strategy

How could the strategy of the company be defined?

85% of the revenue is realized over Christmas, so the business strategy has an extremely seasonal character. Sales orders are placed in January / February, next all items sold are purchased from mostly Eastern manufacturers. When the manufacturers have delivered their products, the logistical process starts whereby Kaemingk delivers all products to their customers.

This reversed process means that 'order intake' is seen as turnover or revenue. The customers responsible for these order intakes can be divided into four different groups:

1) Wholesale trade companies
2) Garden centers
3) Do-it-yourself shops
4) Retailers

90% of the customers is long-standing , 10% consists of new customers. The customers visit the showroom in Aalten and order directly. When a customer has not yet visited the showroom to check the new collection this is noticed and this customer is then actively approached.

How does this strategy influence the determination of KPI's?

The characteristics of the business influence the definition of the KPI's strongly. When an employee within the company talks about revenue, he or she probably means order intake. Any order intake is seen as revenue, even before any invoice has been sent to the customer.

Appendix C.4.5 Points of Improvements

What are the needs (points of improvement) for Performance Management / BI?

The goal should be to present information in a consistent way, very efficient and quick (some indicators should be presented real-time).

When looking at purchases, it should be possible to investigate the indicators further through different dimensions, such as color of items, product group, customer etc. A problem with Oracle JD Edwards is that an article only has 6 characters available for the article number. There are so many items produced and sold that article numbers should be managed correctly and old articles have to be released from the system. So the data should always be correct and up to date.

A risk arises: adding dimensions into a BI solution should be limited.

Order intake indicators must be available at least every week (otherwise it is too late for management to act upon).

Users of a BI tool will be the two directors and 2 or 3 additional people. Dashboard could be presented to more people.

Interesting feature is also the discounts given away by the sales people., It is however not possible for sales people to give discounts out of boundaries set by the directors.

Until October, the delivery status at any specific moment is very important. Which part of the orders is already delivered to the customers. In October, all orders must have been delivered. In this context the inventory position is also important. Inventory turnover on the other hand is not interesting at all. The current inventory position should be expressed in how many specific items are currently in stock. The value of the inventory is of less importance.

Orders processed per employee is also an interesting feature, but probably only real-time. This could be managed to check the current status of an order and verify what orders have a specific status.

Some CSF's:

- Combine long-term KPI's with short-term KPI's
- Restrict access to the tool (maybe use a organizational chart to define which KPI's should be available)
- Connectivity with other systems and integration with other tools

At what management level does the need exist?

There definitely should be a distinction between KPI's at each management level. Some layers of KPI's should only be available to top management.

Appendix C.5 Omron Healthcare

Appendix C.5.1 General information

Interviewees

Dick Zonneveld, General Manager Operations. As General Manager Operations, he is responsible for all operational business of Omron Healthcare in the EMEA region. Direct areas of responsibility are Finance & Accounting, HR, IT and Supply Chain Management/Customer services covering the EMEA region.

Type of company

Omron Healthcare Europe B.V. is part of the Japanese company Omron Corp. Omron is doing business in five business lines: Industrial Automation, Electronic Components, Automotive Electronics, Social Systems and Healthcare. The Healthcare division is originated by the founder of Omron which was a doctor and interested in ethical issues. The Healthcare division ensures 10% of the company's total turnover.

Appendix C.5.2 Interview

Omron Healthcare is more or less a sales / marketing organization selling mainly consumer products. Head office for the EMEA region is located in Hoofddorp with three subsidiaries, located in the UK and Germany. Consolidated revenue is 100 mln.

A key characteristic of the products of Omron Healthcare is the high quality. This is very important because of its healthcare nature. The products are manufactured in Omron's factories located in Vietnam, China and Japan. Omron Healthcare Europe purchases the products from their mother company, and sells them in the EMEA region.

The inventory store has been outsourced to DHL. In each country there are one or two business partners, direct customers and they are responsible for the products to be sold in shops. Products are sold to the consumer market; the professional healthcare market (e.g. hospitals) is difficult to enter. Omron Healthcare home base market is Japan which ensures 50% of total revenue.

Every year, a budget is determined for the upcoming fiscal year. This budget is reviewed every quarter and is the main input for production planning.

The main products sold to consumers are body fat meters, 4-points Libra's, nebulizers and blood pressure monitors (70%). Retail selling takes place via drug stores and / or pharmacies, but this varies per country. Most products have to be registered by the government due to regulations and therefore e-commerce is somewhat difficult to set-up.

Marketing also differs a lot between countries, because of cultural differences. For example, Finland is very consumer driven. However, there is a lot of cooperation in the area of marketing. In countries with English as native language it is easier to share marketing activities, in other countries language is a great barrier.

In sales, seasonal influences are noticeable. In the run up to Christmas the sales volume increases and also with springtime some product sales increase because of hay fever.

Marketing campaigns, such as "Je echte hartleeftijd..." are more specific campaigns initiated by business partners. Of course Omron Healthcare is happy with this kind of free publicity.

Until a year ago, the yearly growth of Omron Healthcare Europe was 10%, so it was quite a fast growing company. The company has its logistics processes outsourced to DHL, but still staff (5 fte) is busy with forecast planning.

The lead time from order to delivery is around 3 to 6 months.

Appendix C.6 Colbond

Appendix C.6.1 General information

Interviewee

Bart-Jan van Beckhoven, Director Logistics & Information Management at Colbond

As logistics director, Bart-Jan van Beckhoven is responsible for the whole logistics process within the company.

Type of company

Short description

Located in Arnhem, Colbond is a global production leader of two types of chemical plastic products:

- **Industrial nonwovens** for flooring, automotive and construction applications
- **3D polymeric structures** and composites for civil engineering, building and industrial applications

It has a history of being part of chemicals giant Akzo Nobel, but when Akzo Nobel decided to sell their fibre division, Colbond was founded in 2004. Initially it was a property of Acordis, property of the CVC capital investor company. But in 2006, Low & Bonar acquired the company. Due to its successes, Colbond recently became responsible for the L&B yarns division. The new yarns division is a difficult but very interesting market. The main competitor and market leader is the Dutch company Ten Cate which has a market share of around 80%. The US market is difficult because the Americans expect service delivery and no long delivery times. In the American sports market, it is important that the club logo is integrated in the sport fields. These logos are designed in all kind of different colors which have to be produced by Colbond to increase their market share.

Colbond has plants located in Arnhem (hq), Emmen, in Germany and in the USA. All of these locations are using Oracle JD Edwards for enterprise resource planning. In the near future, Colbond has the intention to implement Oracle JD Edwards also in the yarns production plants located in Oostende, Dundee and Abu Dhabi.

The Oracle JD Edwards implementation at Colbond was done by Cap Gemini in the past. After the implementation, Steltix became the main supplier and support deliverer for Colbond.

Appendix C.6.2 Interview

In what aspects is the company being managed at this moment?

Reports are created with the implemented Oracle BI tool and some figures are calculated with the use of Excel. Lots of reports are created on an ad hoc basis. So when information is requested, the specific report is drawn up.

Are these aspects satisfactory?

The information needed is being presented in reports, but it is a very time-consuming way. So, from this perspective it is not satisfactory.

Formal procedures for Performance Management / BI?

Some time ago, Colbond and Steltix started a pilot project together on the subject of Oracle Business Intelligence (OBI). This was a new topic for both companies and thus became the first BI implementation

project for Steltix. The scope of this pilot project was set as: change the old-fashioned reporting procedures.

This old-fashioned reporting procedure was characterized as an unwieldly and time-consuming process. Oracle JD Edwards was used to gather the required data, and afterwards these data were interpreted with the help of Excel. These manually created reports were sent to the responsible managers by e-mail. The aim of the OBI pilot project was to improve this process.

The OBI solution is implemented in a "lean & mean" way. The reporting function works in such a way that all predefined reports can be requested by managers. But it is impossible to investigate the presented figures in-depth. There is a need to be able to dig deeper into the reports to find out how the different figures were established. This should be possible in a flexible way (actually the aim of BI was to provide this functionality, so in this way the project has failed).

Technically, the OBI tool is working correctly, but it focuses on the interpretation of information, and not on the technical ability to present the information. The OBI tool itself is working fine.

A specific example of more flexibility is the inventory or stock information. This is currently presented as absolute values (stock volumes) but should also be shown as value expressed in euro.

Different systems are currently used. There is a very good basis of Oracle JD Edwards that can be used efficiently in logistics. The master data of this ERP are considerably good.

Infor PM 10 is used as management information system, and also for sales reports and financial consolidation. A disadvantage is that only one consultant has knowledge about this system. Oracle BI is used mainly for logistical reporting. Data Access Studio (DAS) is built on top of the ERP, and so is GL Inquiry. A disadvantage of these various systems is that sometimes differences in the same figures are presented by the systems, caused by a different interpretation of the definition. Therefore, it would be better to use just one reporting tool.

Appendix C.6.3 Corporate strategy

How does the strategy influence the determination of KPI's?

Stock information is of strategic importance to Colbond. The inventory capacity is around 10 to 12 mln m3 and this is roughly also the sales volume per month. This means that the Days Sales Inventory is about 30 days.

At the Dundee site (yarns production), an obsolete information system is used, and therefore the management has no, or not sufficient, insight in planning and logistic figures. The first step is to implement a good ERP system (Oracle JD Edwards) and use it to improve processes. Improvements are made mostly in the area of Sales, Operations and Planning (supply chain management). After that, information can be derived from collected data.

Logistics are important to Colbond. Areas that get special attention (from strategy perspective) are planning and inventory, order management (customer service), transport and warehousing.

Strategy influences the need for KPI's also in the way that forecasting and budgeting is important. These forecasts are set by the management (based on strategy) and should be used to compare current performances.

90% of all orders are made to order (MTO). Through process optimizing with the help of ERPs it is possible to still deliver the products in time. The production line is easy to change to fit the specific order (for example the width of a nonwoven role).

A 12 months rolling forecast is used and is discussed every month as input for the production planning.

A problem is that recipe changes are not always kept up to date within the ERPs. This has influence on the inventory. This also caused failures in the bill of materials.

Appendix C.6.4 Points of Improvements

What are the needs (points of improvement) for Performance Management / BI?

Every month, logistical KPI's should be presented with the possibility to analyze the different figures in-depth. Technically, OBI has been implemented, but it should now be approached from a functional perspective (business perspective). Priority is to improve the current BI solution.

Business advantages of IT are not at financial but at the operational processes domain. However, process optimization could for example result in automatic invoice processing.

Purchasing processes are very basic and could be improved a lot.

In 2010, Colbond will schedule an improvement program for Performance Management (which can be named as a MIS re-do) and will implement this in 2011. Priority is given to implement Oracle JD Edwards at all (new yarns) sites first.

Transportation management module is used and implemented in a right way, but a desirable KPI is to gain insight in the transportation costs per sales market. These transportation costs are important for the margin. Sometimes it happens that an urgent delivery is needed and then the questions rises who is responsible for the extra costs.

Is this need originating from a top-down or a bottom-up approach?

The need for improvements in Performance Management is top-down driven. There is a need for the management to gain better insight in the production cycle.

At what management level does the need exist?

Both at strategic (top management) as well as tactical (middle management) level. It could also be useful for operations, but what happens now is that operational employees are trying to trick the system.

What could be critical success factors?

- Performance
- Ease-to-use
- Not time-consuming

Appendix D Causal relationship diagram (DuPont)

In Figure 18, an example of a causal relationship diagram is shown.

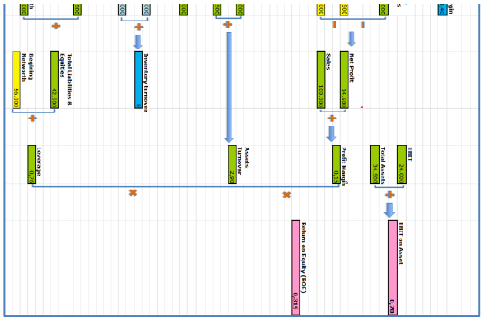


Figure 18: Causal relationship diagram based on DuPont