Business Intelligence - a Maturity Model Covering Common Challenges

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Abstract:

Business Intelligence (BI) has become increasingly important for companies in order to maintain their competitive advantage in a world where the amount of accessible information is increasing rapidly. But still companies do not reach the full business value of their BI investments. A reason for this is the level of maturity of their BI environment. Large Scandinavian companies are commonly at a moderate maturity level and there is room for improvement. But not all companies will benefit from further investments in BI.

Keywords: Business Intelligence, Maturity Model, and Investment Gaps

1. Introduction

BI combines data collection and data storage with analytical tools in order to synthesize information that helps support decision making. It facilitates managerial work and increases the decisions based on relevant information as opposed to decisions based on personal experience and judgment. BI helps decision makers understand the capabilities of the firm, and the trends and future directions in the market environment. BI is an analytical process that converts disintegrated data into knowledge and action-oriented information. This information is then used in the decision making processes and in the achieving of business goals.

The business world has experienced an increase in volume, speed and diversity in terms of data access. Complex, analytical technologies provide information about everything all the time. This data excess has created a crucial need for managing information, and there is an obvious must of timely, precise and up-to-date business information. As a result of this companies today are spending vast amounts of money on information technology (IT). The deployment of IT systems and services has increased tremendously the last couple of decades and companies such as IBM, Microsoft, Dell, SAP and Oracle have experienced an immense growth. However, many experts are questioning whether these investments really do lead to productivity gains for the companies applying the new solutions, or if it does not. Some analysts talk about how companies today may be data-rich but at the same time the might just as well be information-poor. (Stiroh, 2001)

Managers all over the world are well aware of the complex, analytic technologies that are available today for providing insight and support for business decisions. Still, in a survey conducted in 2008 with more than 250 executives, 40% says that their major business decisions are grounded on experience and personal judgment rather than business analytics (Williams, 2011). In an IBM study conducted in 2009 similar conclusions are drawn. Out of 225 business leaders all over the world all agree that there are some or many gaps or lack of trust in information when it comes to extracting and prioritizing relevant information and applying information to optimize operations, to have more predictable outcomes and to understand risk. (IBM Institute for Business Value: LaValle, 2009)

There is clearly a gap between investing in the right technology and using it the right way, or a difficulty in the combination of the both. The challenges when it comes to achieving the full business value of BI investments consist both in technical aspects such as managing data and processes in an efficient way, and business

aspects such as adapting the BI investments to strategic goals and using the BI applications right (Williams, 2011). There are some repeatedly reappearing difficulties that companies struggle with when it comes to BI. A BI maturity model has been developed covering these main gaps that hamper the business value of BI investments. The new maturity model indicates the BI maturity level of an organization, and provides a view of the maturity processes related to each sub category. It can be used by companies to facilitate the understanding of what step in the maturity progress comes next, and how to improve their BI maturity.

2. Method

The initial problem definition was discussed together with professionals within the BI field. A desktop study was conducted that allowed the project team to collect data from earlier published research. Consequently, the theoretical framework is mostly based on secondary data. Further discussions with BI experts were conducted, providing the project team with first-hand knowledge. Summarizing contemporary views on BI, the authors could create a knowledge base within the field (Höst et al., 2006). Besides serving as a knowledge base, the literature research also allowed the authors to explore common operational BI challenges presented as eight propositions. When investigating existing maturity frameworks, it became clear that there was a need for a specially updated and adapted maturity model describing the processes and aspects of the eight propositions. A few models that showed to be of common use were further examined and the different approaches and dimensions of the models were compared. Founding on already existing frameworks, a new maturity model was constructed. The new model focused on the examined propositions. A survey was sent out to 112 large Scandinavian companies, i.e. companies with more than 250 employees and annual revenue higher than 50 million euro (Europeiska Kommissionen, 2006; Tillväxtverket, 2011), from various industries. The rate of response was 20%. This bottom-up approach aimed to illustrate propositions recognition level and the maturity level of the top 100 Scandinavian companies. In order to gain deeper knowledge, to be able to both verify the results from the survey and understand the reasons behind the outcome, a top-down approach was taken (Lekwall and Wahlbin, 2001). Three case studies were performed, based on in-depth interviews held with BI knowledgeable employees at three different companies.

This project is limited to verifying the eight propositions stated below. The developed maturity model covers a chosen set of sub dimension, which means there are groups of criteria more or less important to focus on for some organizations. Also, there are groups of criteria that are left out in the model that might be important to focus on for some organizations. The research is restricted to large Scandinavian companies, and the study should thus be considered covering this geographical area with focus on large companies.

3. Literature Review

According to the literature, there are gaps between investing in a better BI environment and achieving the full business value of the BI environment. (Williams and Williams, 2007; Popovic, 2007; Hagerty & Hostmann, 2010)

BI end users spend too much time on preparing and producing reports. The final analysis delivered to the end user lack useful content or is not entirely corresponding to the end users needs. The user wastes time on tasks that are not really his or hers to do, time that could have been spent on analyzing the information (Popovic, 2007; Williams and Williams, 2007; EY, 2013a). This leads to the first proposition.

> **P1:** Retrieving data: Substantial amount of man hours are wasted on retrieving data

There is a lack of trust in the reports and analysis delivered to the users due to various definitions on the same object. Multiple data sources, different data formats or different software/hardware that is used lead to different data representing the same thing. (Popovic, 2007; Chaudhuri, 2011; Williams and Williams, 2007; EY, 2013a)

> **P2**: One version of the truth: Multiple definitions on the same object; there is a large need for "One version of the Truth"

Various technologies are often used in an organization. One department can be used to one particular technology, whereas another

department prefers another one. Consequently, there will be several technologies in use, often solving the same tasks. This is both a waste of time and money, and is likely to increase the risk of no single version of the truth. (Ong et al., 2011; Watson, 2009; EY, 2013a)

> **P3**: Technologies: Duplicated technologies solve the same tasks

The BI environment may be designed and implemented, but an overview may still be missing meaning that the end user is not aware of the available resources and how the BI environment can be used. This implies that end users throughout the organization do not fully understand and profit from the BI system. It might also be a problem that the company have information and the competences to extract and analyze the information but is not aware of the possible value of it or that it even exists. (Popovic et al., 2010; Wixom and Watson, 2002; Williams & Williams, 2007; EY, 2013a)

> **P4**: Competencies: Required BI competencies to satisfy needs are already present in the organization, but an overview is missing.

If the metadata is not clear and accessible for all users, the traceability and transparency of the data decrease. Data quality issues affect the reliability in data (Graham, 2008). This leads to a lack of trustworthiness, and end users will need to go back and find out where the data comes from before using it. Inaccessible and inconsistent metadata thus decreases the reliability of the information and implies redundant work. (Davenport and Harris, 2007; Ong, 2011; TDWI Research: Loshin, 2013; EY, 2013a)

> **P5**: Transparency: Low reliability and transparency in data leading to redundant work

If the BI investments are not aligned with the company's strategic goals, then the BI investment will not add value to the core business processes. This means the BI analysis will not be useful no matter how correct and timely the delivered information is. (Cooper et al., 2000; Williams and Williams, 2007; EY, 2013a)

> **P6**: High cost: Few BI consumers per report and low reuse of data give a high cost per report

Instead of using BI analysis in a proactive manner in order to prevent and adapt to the business environment and changing opportunities and threats, BI reports are often used in a more reactive way. Managers use the information in an ad hoc manner as it appears, and apply it on any operational application that is available. (Hagerty & Hostmann, 2010; TDWI Research: Eckerson, 2007; EY, 2013a)

> **P7**: Reactive rather than proactive: Reporting focused on looking backwards and less on identifying business opportunities

Parallel BI processes that lack standardization and alignment often implies wasted resources and confusion within the organization since there are multiple analysis on the same thing. The cost for the overall BI environment is likely to increase, and there will be less compatibility, understanding and cooperation across the organization and its business processes. (Barki, 2005; Hines & Rich, 1997; Popovic et. al., 2010)

> **P8**: BI Processes: The organization has a large amount of parallel BI processes, many of those lacking standards, documentation and alignment.

According to the study conducted all of the propositions where recognized among the responding large Scandinavian companies.

Various maturity models have been developed aiming to better understand why and when companies experience BI challenges. The BI maturity models try to describe what the common difficulties are when it comes to establishing BI applications and reaching its full business value, and where in the maturity process of BI that they are usually encountered. Different maturity models cover somewhat different aspects of BI, and most of the models focus on one or several specific domains. However they all provide a framework for comparison and a way to highlight areas within an organization that needs specific attention (Rajateric, 2010). Below six different types of maturity models are presented.

The Business Information Maturity Model by Williams and Thomann

The Business Information Maturity Model by Williams and Thomann focuses on the business and organizational culture aspect of BI maturity. It suggests that in order to capture the full value associated with established BI technologies, an organization must not only look at BI as a technical concern and a change in technological tools, but also see the importance of changing the way business is conducted. That is, the maturity when it comes to business use of technology need to match the technical maturity. The organizational changes comprise three main points: understanding of how information can be better incorporated in order to back up the business, more efficient manner to define business requirements, and increased use of delivered information. (Williams and Thomann, 2003) When mapping an organization with regards to the Business Information Maturity Model three main factors for BI success are defined: alignment and governance, leverage, and delivery (Williams and Williams, 2007).
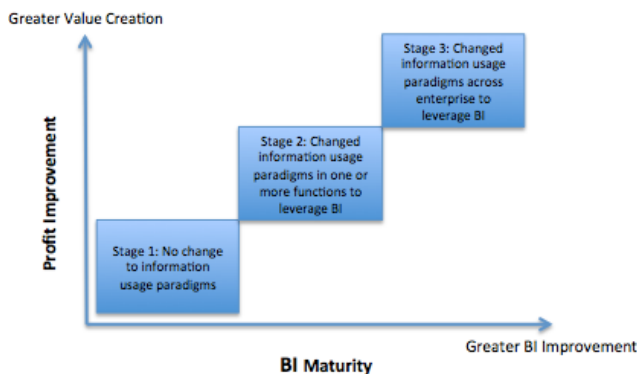

Figure 1: Business Information Maturity Model by Williams and Thomann

AMR Research's Business Intelligence/Performance Management Maturity Model, Version 2

The AMR Research's Business Intelligence/Performance Management Maturity Model, Version 2 describes a framework comprising technical aspects of BI in the lower levels of maturity, and then business and cultural aspects in the higher levels. The process goes from a technology-centered organization to an organization where culture, technology and philosophy are merged and business decisions are based rigidly on numbers. As the title suggests the model focuses both on BI and performance management and the key areas on which the

companies are evaluated on are technology, BI tools, processes and performance culture. (Hagerty, 2006)
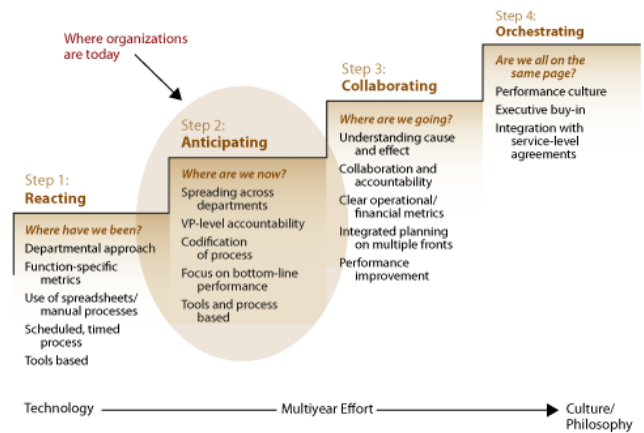

Figure 2: AMR Research's Business Intelligence/Performance Management Maturity Model, Version 2

Enterprise Business Intelligence Maturity Model

The Enterprise Business Intelligence Maturity Model (EBIMM) draws from BI literature as well the Capability Maturity Model (CMM) concept. CMM is a framework describing levels of maturity where the final stage is characterized by an organization with predictable processes that are continuously improving. The EBIMM combine these maturity levels with three key BI dimensions: data warehouse, information quality and knowledge process. These dimensions are seen as three major functions of which successful BI processes depend. (Chuah, 2010)
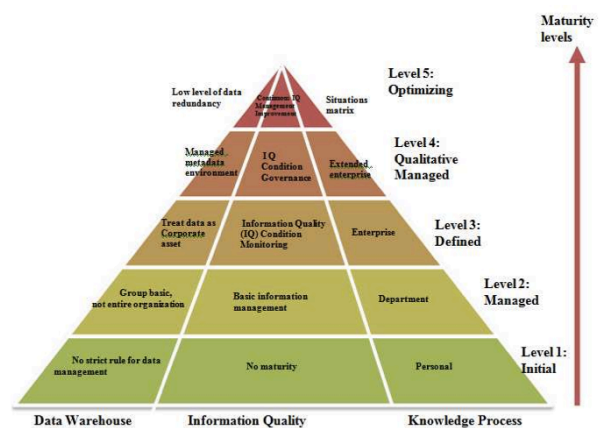

Figure 3: Enterprise Business Intelligence Maturity Model

Business Intelligence Maturity Hierarchy by Deng

The BI Maturity Hierarchy model by Deng defines four stages within knowledge management from which BI maturity is evaluated: data, information, knowledge and wisdom. At the final stage the

company is described as an organization that use high quality data to deliver rigorous and timely analysis on which all business decisions are made. The business productivity is high, the BI system efficient and the competitive advantage increases. (Deng, 2007)
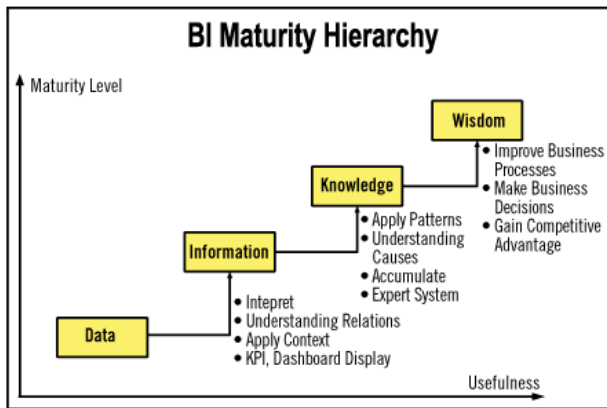

Figure 4: Business Intelligence Maturity Hierarchy by Deng

TDWI's Maturity Model
The TDWI Maturity Model is a widely known and used framework (Williams and Williams, 2007). Initially, the major focus of this framework was on the technological aspects of BI. The areas of evaluation were scope, analytic structure, executive perception, type of analytics, stewardship, founding, technology platform, change management and administration (Eckerson, 2004). In 2009 however, a poster was published by TDWI containing an updated version of the framework. It is more complex than its predecessor and adds cultural and business aspects to the evaluation criteria. The poster looks at four main aspects that affect the BI usability: architecture, analysis/design, support, and change management. Each domain comprises several components. Architecture contains flexibility, data, delivery, and performance. Analysis/design includes roles, requirements, and BI frameworks. Support incorporates feedback, training, services, and rapid development. Finally, change management comprises marketing, leadership and managing expectations (TDWI Research: Eckerson, 2009).
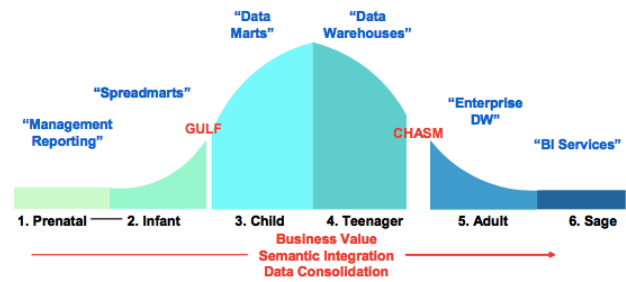

Figure 5: TDWI's Maturity Model

Gartner's Maturity Model for Business Intelligence and Performance Management
As suggested in the title, Gartner's Maturity Model for BI and performance management assesses both the BI maturity and performance management maturity. The main areas of evaluation are people, skills, processes, and technologies. Subareas include ad hoc, query, reporting, OLAP, data integration, data warehouse, analytical applications, such as customer service analytics, and performance management applications. The model discusses trust of information, adaptability to a changing business environment, and integration of external users of BI such as suppliers, business partners, and customer. (Hagerty and Hostmann, 2010)
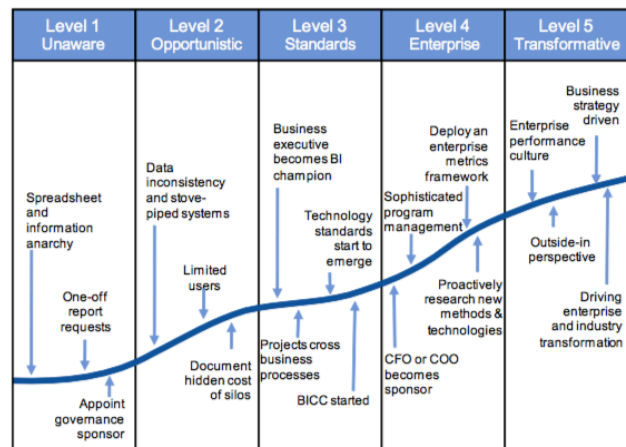

Figure 6: Gartner's Maturity Model for Business Intelligence and Performance Management

HP Business Intelligence Maturity Model
The HP Business Intelligence Maturity Model focuses on three BI dimensions: information technology, business enablement, and strategy and program management. Within each dimension there are five subcategories that the company is evaluated on. Information technology comprises ad hoc solutions, localized solutions, shared resources, enterprise operationalized, and enterprise services. Business enablement incorporate facts and data for running the

business, information for measuring and monitoring the business, insight for integrating performance management and intelligence, knowledge for fostering business innovation and people productivity, and foresight for creating strategic agility and differentiation. Strategy and program management includes operation, improvement, alignment, empowerment, and transformation. (HP, 2009)
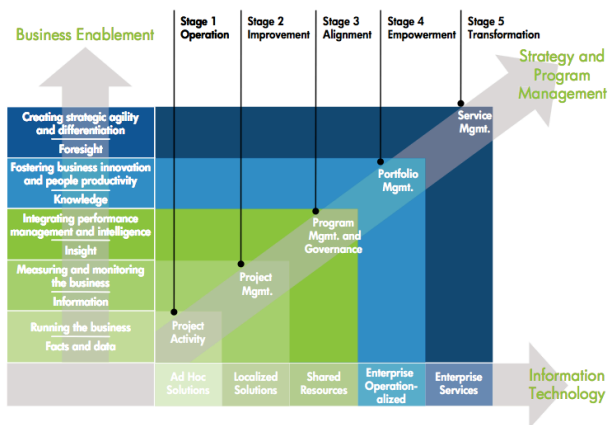

Figure 7: HP Business Intelligence Maturity Model

Why a new maturity model?

The dimensions that the existing maturity models are bringing up according to the compilation are not necessarily fully explained at every maturity phase, but it is mentioned and covered to some extent in the models. This indicate that even if an existing maturity model contains most or all of the requested areas they might still not fulfill the full explanation needed to cover the eight propositions. Also, the models generally lack an explanation of the path to follow in order to improve the maturity within a specific dimension, i.e. a description that points out all steps of the improvement process. Thus, the maturity models are difficult to follow and interpret. Because of this, a new BI maturity was developed for this project that covers the relevant aspects with regards to the examined propositions.

4. Proposed Maturity Model

Inspiration has been drawn from the above described maturity models, specifically the TDWI maturity model. Together they cover a wide range of dimensions. The developed maturity model provides a clear and structured framework to follow and distinctly shows the maturity process for each aspect. The developed BI maturity model focuses on two main categories of BI, technical and business. The technical maturity contains the

subcategories architecture, standardization, metadata and BI applications. The business maturity contains the subcategories use of BI, strategic alignment, acceptance and process integration. One more subcategory is included in the model which is comprised in both technical and business maturity; change management.

The developed BI matrix aims to provide companies with an overview of their current maturity level in the different categories. The matrix has two dimensions; the rows contain the benchmark categories and the columns comprise the BI maturity stages. There are five stages of maturity: Unaware, Operational, Tactical, Strategic, and Optimized. Unaware is the least mature stage and optimized is the highest level of maturity. The business value of BI increases along with the maturity growth. In the matrix each subcategory is explained for each maturity phase. See figure 8 for the full model.

5. Analysis

BI Maturity within Sub Categories

Each of the maturity model's sub categories was found to be essential for a company to have a complete, well-functioning BI environment. Below follows an explanation of the difficulties found in terms of each sub category.

Architecture

Different business units, departments and countries often have independent data warehouses to some extent and only selected data is consolidated. The different data warehouses usually exist because they have been developed to support a single department, country or business unit. Too many independent data warehouses are seen as a disadvantage and common data storage is normally aimed for. Also, the BI architecture must be adapted to the vast amount of data that the company handles, this to avoid slow processes. It is a big project to change the BI architecture of a large company and it is connected to large investments and long periods of time. It is also complex and there are many factors influencing the success, therefore it usually takes several attempts before the result is satisfying.

Standardization

The standards for key terms and metrics differ between business units, departments, and

countries to some extent, especially when different IT solutions have been used. This is mainly causing problems when the different business units start to collaborate more. However, more cross-company standards seem to be the general aim, which eliminates conflicting key terms and metrics as well as technologies and tools. The more the departments see the need for a more cross departmental process based way of working, the more they will realize the importance of standardized definitions in the company. More standardization generally lead to reduced complexity, license costs, training costs, and administration costs.

Different business units might be accustomed to different technologies and they have found a technology that fits their needs that they are comfortable with. If the company is going to use a standard set of technologies they have to find technologies that fit all the needs of the already existing solutions. Another difficulty in standardizing the technology is that it will make employees change the way they work, which is not easy and takes time and resources.

		Unaware (1)	Operational (2)	Tactical (3)	Strategic (4)	Optimized (5)
Technology	Architecture	Spreadmarts.	Independent data marts.	Independent data warehouses.	Enterprise Data Warehouse.	The BI environment is extended to suppliers and other external actors.
	Standardization	Defined, documented and implemented standards and rules for **no one** of key terms and metrics as well as for technology and tools	Defined, documented and implemented standards and rules for **some** key terms and metrics as well as for technology and tools.	Defined, documented and implemented standards and rules for **half** of the key terms and metrics as well as for technology and tools.	Defined, documented and implemented standards and rules for **most** key terms and metrics as well as for technology and tools.	Defined, documented and implemented standards and rules for **all** key terms and metrics as well as for technology and tools.
	Data Quality	The quality is dependent on the technical programmer analysts and coders. The users can not access any metadata.	There are ad hoc, firefighting, solutions to data quality issues. Metadata reports are produced and distributed periodically.	There are standardized data quality control activities and the owner of the data is responsible for the data quality. There are several metadata repositories accessible for the user.	There are few data quality issues and proactive data quality controls. There is a central repository accessible to the user with up-to-date metadata.	Continually improved and evaluated data quality management processes. The users can easily access up-to-date, relevant, and integrated metadata.
	BI Applications	Use a standard set of statistical reports. Users can access none of the data they need from a single user interface.	Ad-hoc reporting, OLAP. Users can access some of the data they need from a single user interface.	Dashboards and scorecards. Users can access most of the data they need from a single user interface.	Predictive analytics; data and text mining. BI for the masses. Users can access all the data they need from a single user interface.	Closed-loop and real-time BI applications.
Business	Use of BI	Ad hoc and random use of BI. Few users per BI report. Only power-users and executives benefit from BI.	BI is used reactively on operational level (fire fighting).	BI is used on tactical level. Knowledge users also benefit from BI.	BI is used proactively, supporting the business strategy. No decisions depend on tacit knowledge.	BI is the founding and driving force of the company strategy. BI optimizes the supply chain.
	Strategic alignment	Information requirements are not defined. End users see the data in an unstructured way.	End users define what information they need and the BI applications are adapted to the specified needs.	The information needs are linked to business processes that support business goals.	End users have a strong understanding of how the BI is supporting business functions and goals.	BI is a core competitive advantage, and is what differentiates the company.
	Acceptance	The users do not trust or use the delivered data due to errors, exceptions, or omissions.	Users trust their own departments/groups BI reports.	Users trust the data more than previous steps, but reconcile the reports with other sources.	The users trust and use the data.	BI is embedded in the company culture. All delivered BI reports are fully trusted and accepted.
	Process Integration	Functional silos.	Understand the business processes but they are not mapped. Business processes are not supported by BI information.	Mapped the processes and information assets. Incorporates BI information in the processes. A BI team governs the BI environment.	Cross-departmental process integration. BI affects the business processes design and how employees work.	Cross-organization process integration.
Change Management						

Figure 8: Developed Maturity Model

Data Quality

Data quality issues seem to occur in most companies, at least from time to time. To prevent this standardized data control activities are used to various extent, e.g. customers checking and signing data, "outlier reports" that identify entries that deviate beyond a specific tolerance level, checking that data is correctly loaded into repositories. At some points, and at some departments where data quality is a bigger issue, data entries are checked manually. The data quality is of great importance in order to make the BI environment useful for the company. If there are quality problems in the data employees will stop using the data because they do not trust it, or they might base decisions on the incorrect data, which will impact the company negatively.

Another factor in making the data trustworthy is to make it traceable. This is why metadata is important, helping to determine the source of data and make it traceable. However, metadata is not always available to the users and companies do not generally consider this to be a main issue. Still, they agree that more accessible metadata would positively affect the trust of data. As the companies increase their overall maturity they will probably realize the value of available structured metadata.

BI Applications

Companies generally use dashboards and scorecards that are accessible to all users from a single user interface. Since all information that the users need is not always available (standardized reports) users sometimes develop their own reports themselves. Overall the companies are satisfied with using scorecards and dashboards and are not interested in more advanced applications. Focus might instead be on improving the dashboards, scorecards and reports to make them satisfy more of the users needs so that they do not need to build and modify the reports themselves. It is also of interest to make all the information available for the users from a single user interface.

The most important is not to have the newest or most advanced applications but instead to make the employees use the information. If the information is not used in the processes, advanced new applications are of no use. The companies need to evaluate if the users need more information than they already have. If the information they have now is not used then the users will probably not use the more advanced information either, but if the information is used and there is a need for more information it is probably worth investing in more advanced BI applications.

Use of BI

BI is used throughout the organization at most large companies although the usage seems to differ between departments. Departments that have integrated BI in the business processes and depend on the BI information use it to a larger extent than departments that recently has introduced BI. BI is used both in a proactive and reactive manner. It is looked at to see what has happened, and when the information is usable for proactive decisions it is also used in that way.

There is a general acceptance for how executives make decisions and the issues they decide on are often considered too complex for data alone to be sufficient as decision base. Because of this it is extremely difficult to reach maturity level 5 where BI information drives the business and is the sole decision factor, and this is not something companies normally strive for. The optimal width and type of BI users differs between organizations and situations, meaning that high usage of BI by all employees is not always beneficial.

Strategic alignment

All companies agree on the importance of strategic alignment, but also on its difficulty to achieve because of a too complex existing BI environment (due to large, scattered organizations) and lack of information overview. Companies generally look for ways to make their BI architecture less complicated and more efficient, leading to better information overview. This is a step in the direction of aligning the BI environment with the company strategy.

The communication between the business and IT side is highly important. If the IT side is not told what must be done, they do not do it. At some companies BI starts out as a performance management project where the business aspect of BI is always in center. They develop IT solutions depending on what the business processes need. Other companies that have locally developed BI environments normally have more problems with the business alignment. Their IT solutions are

only adapted to the local department's needs instead of the company as a whole. This often indicates problems with sub-optimizations. Increasing the strategic alignment is a slow process and is preferably done little by little.

Acceptance

Generally users trust and accept the information, but it differs from department to department. The more people have used the information before, the more they trust it. When there have been data quality issues due to architectural changes, wrong input of data etc. the trust has decreased. By time, the trust has been built again. The trust in data is therefore somewhat fluctuating, but over time it is increasing due to improvements in the BI environment and increased usage. When the users do not trust the data fully they might reconcile it with other sources before using it or not use it at all. The acceptance is something that will take time and is highly dependent on other subcategories in the maturity model, e.g. data quality. Although companies want to reach a high level of maturity in this area there are a lot of factors that needs to be handled and it is a slow, time-consuming processes. Important decisions are usually not taken with data as the only decision base, since data often is not trusted enough to serve as decision base for complex problems. Usually some other decision factors are used such as personal experience and recommendations. A tendency is that that people normally do not trust data, people trust people.

Process Integration

Companies have several business processes. The companies seem to be aware of the business processes and have mapped them, and they are aware of the information need in each business process. There is no business value in BI if the information is not used in the business processes. To ensure that the information is used BI has to be aligned and incorporated into the business processes. It is important to have an owner of the BI processes and projects both from the business side and the IT side. They are responsible for the data and that all the information needs are fulfilled, and so they decrease the gap between IT and management. Large companies often do have an owner from the business side and the IT side, which they mean helps the BI environment to support the core business processes.

Change management

Change management is crucial for all BI projects to succeed. Employees are generally resistant to change, especially if new demands and instructions come from the top management that are perhaps not placed in their country, and as far as the employees believe they have not enough understanding of their working requirements and needs. All users need to accept the need for new tools, understand why it is beneficial, and learn how to use it in order to succeed with the BI investments.

Company Size's Impact on BI Maturity

The survey shows that the responding companies are close to the middle i.e. they have somewhat moderate maturity. This could be because large companies have been examined, and in order to build and run a large company there is a need for a working IT landscape and BI environment. Thus the companies are likely to have made some BI investments. However, to reach the higher levels of maturity there are several large barriers to overcome which demands full support from executives, large investments and full acceptance throughout the company. This kind of BI maturity is difficult to achieve and there are few companies that have managed to do so. Concluding from the survey as well as the case studies moderate BI maturity is common among large Scandinavian companies, and there is room for improvement in terms of BI performance.

Due to the size of the companies there are characteristics that contribute to their complex BI environments. The companies are often active in several countries maybe even in different continents. The departments are often big and somewhat independent from one another. The companies might have grown through acquisitions where new technology and data has been added that need to be integrated into the company. Or the companies have started their BI processes department-by-department and as the need for aligned BI processes and a common data warehouse arises there is vast amount of technology, data repositories and application to integrate and align. In a big company there are also vast amount of data that needs to be handled, and the amount of available data is increasing. There is also many people and department with different needs, habits and experience. Changing the business takes a lot of effort and time before everyone adheres to the new way of doing things

and adapt to the changes. It is a complex environment where changes take time.

In order to stay competitive constant adaption to changes in the environment are necessary. Improvements in the BI environment can thus always be made. This means that BI projects should never be finished and closed down, but instead constantly improve and change the BI environment along with changing circumstances. BI can thus be seen as a iterative program without finish date.

Why Large Companies do not improve their BI Maturity

From the study three main reasons for not increasing the BI maturity concerning both technical and business aspects were concluded; complexity, high costs, or not useful. Complexity refers to that the taking the step to the next level of BI maturity is too complex. This is often because there is simply too much information to take into account, and all this data accumulated implies slow processes and highly complex BI architecture. It takes highly advanced technical solutions to consolidate and sort all data, which might not even exist. There is a question about tradeoff between a compiled, standardized solution and the satisfaction of individual needs. Complexity also comprises large needs for change management. Large companies that have grown through acquisitions of other firms often have a highly complex and varying both technical and business environment, and the change management needs to make new BI solutions work throughout the organization are therefore large. Companies are not hindered by the complexity by default, but the complexity hampers and slows down the BI maturity. High costs refers to that the costs for implementing new BI solutions are often high, e.g. a new ERP-systems or new BI applications have high implementation costs, take long time to develop and make employees use. Also, more costs are often added along the development processes since new needs are discovered, and changes often have to be made once the new system is implemented. Not useful is when there is no strong need for higher BI maturity. E.g. more metadata or better standardization might not matter to the users, or a standard set of statistical reports might be just what is needed and preferred in the company. In other words, the

company is not ready for higher BI maturity, and it will not be beneficial to them.

6. Learnings

Increasing the BI maturity level might imply large investments. It is therefore important for companies to consider if it is worth the investment. Main reasons for not increasing the maturity is that the environment is to complex and will involve very large investments and changes in the way people work. Sometimes higher BI maturity is simply not beneficial enough.

Nevertheless; better business decisions are something that cannot be neglected in the long run for any large company, and thus the BI environment plays a main role in terms of core strategy. Advantages such as efficient and effective business processes are shown to be linked to the organization's BI maturity. The more competitive the business world becomes, and the more information access there is, the more important accessible and correct information becomes. It will be increasingly difficult to stay competitive without a well-functioning BI environment. Large companies should therefore reflect on their BI maturity and look into how they can improve their use of BI in order to make better business decisions.

Another key learning is that BI should not be seen as a project with a beginning and an end but rather as an ongoing program since successful BI requires continuous adaptions.

7. References

Barki, H. and Pinsonneault, A., 2005. A Model of Organizational Integration, Implementation Effort, and Performance. *Organization Science*. 16(2), pp.165-179

Chaudhuri, S., Dayal, U. and Narasayya, V., 2011. An Overview of Business Intelligence Technology. *Communications of the ACM*, 54(8), pp.88-98.

Chuah, M-H., 2010. An enterprise Business Intelligence Maturity Model (EBIMM): Conceptual Framework. In: University Tunku Abdul Rahman, Department of Knowledge Science, Malaysia, *Fifth International Conference on Digital Information Management.* Thunder Bay, Canada. 5 May 2010. USA.

Cooper, B., Watson, H., Wixom, B., and Goodhue, D., 2000. Data Warehousing Supports Corporate Strategy at First American Corporation. *MIS Quarterly*, 24(4), pp. 547-567.

Davenport, T. H. and Harris, J. G., 2007. The Architecture of Business Intelligence [pdf] Avalable at: http://www.accenture.com/SiteCollectionDocuments/PDF/ArchBIAIMS.pdf

Deng, R., 2007. Business Intelligence Maturity Hierarchy: A New Perspective from Knowledge Management. *MDM&Data Governance Summit,* [online] Available at: http://www.information-management.com/infodirect/20070323/1079089-1.html#Login [Accessed 21 September 2013].

Eckerson, W., 2004. Gauge Your Data Warehouse Maturity. *Information Management,* [online] Available at: http://www.information-management.com/issues/20041101/1012391-1.html?zkPrintable=1&nopagination=1 [Accessed 2013-11-19]

Europeiska Kommissionen. 2006. *Den nya definitionen av SMF-företag.* [pdf] Publikationsbyrån. Available at: http://ec.europa.eu/enterprise/policies/sme/files/sme_definition/sme_user_guide_sv.pdf [Accessed 2013-10-04]

EY, 2013a. Master Thesis contents 20120523. [pdf] *EY Advisory Services*

Hagerty, J. and Hostmann, B., 2010. *ITScore Overview for Business Intelligence and Performance Management.* [pdf] Gartner, Inc. Available at: http://www.gartner.com/id=1433813 [Accessed 21 September 2013]

Hines, P. and Rich, N., 1997. The Seven Value Stream Mapping Tools. *International Journal of Operations & Production Management.* 17(1), pp.46-64.

HP. 2009. *HP Business Intelligence Maturity Model: Describing the BI journey.* [pdf] Hewlett Packard Development Company, L.P. Available at: http://www.computerwoche.de/fileserver/idgwpcw/files/1935.pdf [Accessed 2013-09-22]

Höst, M., Regnell, B. and Runesson, P., 2006. Att genomföra examensarbete, Malmö: Studentlitteratur.

IBM Institute for Business Value, 2009. *Business Analytics and Optimization for the Intelligent Enterprise.* [pdf] NY, United States of America. IBM Global Business Services. Available at: http://www-05.ibm.com/de/services/bao/pdf/gbe03211-usen-00.pdf [Accessed 2013-09-18]

Lekvall, P. and Walbin, Clas., 2001. Information för Marknadsföringsbeslut. Göteborg: IHM Publishing.

Ong, I. L., Siew, P. H. and Wong, S. F., 2011. A Five-Layered Business Intelligence Architecture. *Communications of the IBIMA*. 2011, pp.284-285.

Popovic, A., Turk, T. and Jaklic, J., 2010, Conceptual Model of Business Value of Business Intelligence Systems. *Management: Journal of Contemporary Management Issues.* 15(1), pp.5-29.

Rajteric, H. 2010. Overview of Business Intelligence Maturity Models, *Management*, 15(1), pp.47-67.

Stiroh, K., 2001. Investing in Information Technology: Productivity Payoffs for U.S. Industries. *Current Issues in Economics and Finance*, 7(6), pp.1-6.

TDWI Research: Eckerson, W. 2007. *Beyond the Basics: Accelerating BI Maturity.* [pdf] The Data Warehouse Institute. Available at: <http://www.sdn.sap.com/irj/scn/go/portal/prtroot/docs/library/uuid/b070feb8-ecd4-2910-e9b9-c495b4d30c67?QuickLink=index&overridelayout=true&12962211329836> [Accessed: 2013-09-21]

TDWI Research: Eckerson, W., 2009.*TDWI's Business Intelligence Maturity Model.* [pdf] The Data Warehouse Institute. Available at: http://tdwi.org/pages/posters/business-intelligence-usability/download.aspx [Accessed: 2013-09-21]

TDWI Research: Loshin, D., 2013. *Trusted Information for Analytics.* [pdf] The Data Warehouse Institute. Available at: http://tdwi.org/research/2013/03/tdwi-checklist-report-trusted-information-for-analytics/asset.aspx?tc=assetpg [Accessed 2013-09-18]

Tillväxtverket. 2011. EU:s definition av SMF/SME. *Insatser för tillväxt*, [online] Available at: http://www.tillvaxtverket.se/huvudmeny/insatserfortillvaxt/flerochvaxandeforetag/cipkonkurrenskraftochinnovation/eusdefinitionavsmfsme.4.21099e4211fdba8c87b800017125.html [Accessed 2013-10-04]

Watson, H. J., 2009. Tutorial: Business Intelligence - Past, Present, and Future. *Communications of the Association for Information Systems*. Vol. 25, pp.487-510.

Williams, S., 2011. 5 Barriers to BI Success and How to Overcome Them, *Strategic Finance,* 93(1), pp. 26-33.

Williams, N. and Thomann, J. 2003. *BI Maturity and ROI: How Does Your Organization Measure Up?* [pdf] Gaithersburg USA: DecisionPath Consulting. Available at: http://www.decisionpath.com/docs_downloads/TDWI%20Flash%20-%20BI%20Maturity%20and%20ROI%20110703.pdf [Accessed 2013-09-15].

Williams, S. and Williams, N., 2007. The Profit Impact of Business Intelligence. San Francisco: Morgan Kaufmann Publishers.

Wixom, B. H. and Watson H. J., 2001. An Empirical Investigation of the Factors Affecting Data Warehousing Success. *MIS Quarterly*. 25(19) pp17-41. Published by: Management Information Systems Research Center, University of Minnesota. Available at: http://hinf551edwcase.wikispaces.com/file/view/3250957.pdf