

Patrick Hammer

Bachelorarbeit
im Fach Spezielle Wirtschaftsinformatik

**Success Factors for Business Intelligence and Analytics for
Decision Making**

Themasteller: Jun.-Prof. Dr. Ali Sunyaev

Vorgelegt in der Bachelorprüfung
im Studiengang Wirtschaftsinformatik
der Wirtschafts- und Sozialwissenschaftlichen Fakultät
der Universität zu Köln

Köln, September 2013

Inhaltsverzeichnis

List of abbreviations	III
List of figures.....	IV
List of tables	V
1. Introduction.....	1
1.1 Problem Statement	1
1.2 Structure of the paper	2
1.3 Research approach.....	2
2. Decision Making.....	3
2.1 What is Decision Making?	3
2.2 Types of Decisions	5
2.3 Strategic Decision Making Process.....	6
2.4 Challenge.....	8
2.5 Cognitive Simplification Process	8
3. BI&A.....	11
3.1 What is BI&A?.....	11
3.2 Types of BI&A.....	12
3.3 BI&A for Decision Making.....	14
3.4 BI&A for Decision Making limitations	16
4. Success Factors	17
4.1 What is a Success Factor?	17
4.2 Success Model.....	18
5. Success Factors for BI&A for decision making	20
5.1 Overview	20
5.2 Human Factors	23
5.3 Technical Factors	28
5.4 Organizational Factors	30
6. Final Evaluation	36
Erklärung	41
Lebenslauf.....	42
7. Literaturverzeichnis	44

List of abbreviations

BA	Business Analytics
BI	Business Intelligence
BI&A	Business Intelligence and Analytics
BI&AS	Business Intelligence and Analytics System
BIS	Business Intelligence System
BPM	Business Performance Management
DM	Decision Making
DSS	Decision Support System
EIS	Executive Information System
IS	Information System
IT	Information Technology
MIS	Management Information Systems
MSS	Management Support System
OLAP	Online Analytical Processing
SF	Success Factor
SMP	Strategic Management Process

List of figures

Fig. 2-1: The conventional decision making process.....	4
Fig. 2-2: Information requirement by level of management activity.....	5
Fig. 2-3: The strategic management process.....	7
Fig. 3-1: Typical BI&A architecture.....	12
Fig. 3-2: Evolution of the DSS field.....	13
Fig. 4-1: Success Model.....	18
Fig. 5-1: Overview.....	20
Fig. 6-1: Ranking of success factors on system type.....	39

List of tables

Tab.: 5-1 Knowledge.....	23
Tab.:5-2 Individual Motivation.....	25
Tab.: 5-3 PsychologicalFactors.....	27
Tab.: 5-4 Flexible Framework.....	28
Tab.: 5-5 BI Maturity.....	29
Tab.: 5-6 Culture.....	30
Tab.: 5-7 Communication.....	32
Tab.: 5-8 Additional Processes.....	34

1. Introduction

1.1 Problem Statement

In every industry, in every part of the world, senior leaders wonder whether they are getting full value from the massive amount of information they have within their organizations.¹ New technologies are collecting more data than ever before, yet many organizations are not able to use their already existing data sufficiently.² Today's leaders must now be able to respond more cogently and convincingly to inquiries about competing on analytics.³ As the competitive environment becomes more and more complex, company stakeholders demand more and better support to compete in the markets.⁴

Business intelligence and analytics (BI&A) is about technologies, systems, practices, and applications analyzing business data, converting them into new and better insights about business and markets.⁵

It is a topic for research to analyze which success factors determine the success of a BI&A system during usage.

The problem in research comprises the lack of sufficient success factors for BI&A for decision making. By gathering and explaining success factors for BI&A, research can help create an awareness of the different success factors and offer help for companies to understand these factors.

The main aim is to derive success factors for BI&A systems for decision making. For this purpose success factors from current literature as well as success factors based on decision making are collected and distributed into different categories. Furthermore, they are explained to have a clear and unequivocal understanding of the success factors.

¹ Cf. Hopkins (2011), p. 21.

² Cf. Ee-Peng Lim, Hsinchun Chen, Guoqing Chen (2013), p. 172.

³ Refer to chapter 2.4.

⁴ Refer to chapter 2.4.

⁵ Refer to chapter 2.1 and 2.2

1.2 Structure of the paper

In chapter two the fundamentals of the decision making process will be explained to have the relevant understanding for the following chapters of this thesis. For this purpose the decision making process is fragmented and put in the point of view of basic descriptive decision theory and psychology. Furthermore, the challenges of modern decision making will be explained.

In chapter three the fundamentals of BI&A will be explained to have a basic understanding about what the term comprises. Then the different types of BI&A systems and how they are distinguished will be explained. Then BI&A will be put in context with decision making to show how BI&A is used to support it. Lastly the problems of BI&A for decision making are shown.

In chapter four the necessary definition of a success factor and the success dimensions for the success factors will be listed.

In chapter five the collected success factors are shown. They are divided into different categories and explained.

In chapter six a final evaluation will be given over the findings and limitations of this work.

1.3 Research approach

I will get a broad overview of the subject by reading papers of leading journals. Then I will check selected conference proceedings with high reputation. Then, after I have gained insight into the topic, I will start to distribute the topics in subtopics for further clustering.

For the main research I will use the concept of search lists on the keywords “Business Intelligence”, “Business Analytics”, “Decision Making” and “Success Factors” using these terms and their synonyms. Using that search string with the information systems senior basket I will pick the most relevant literature based on the abstract. On this basis

I will review the citations of the articles I found in the rough overview to determine prior articles that should be considered. After that I will go forward by using Web of Science to identify articles citing the key articles I found before and determine which of these are relevant for my research.

For the purpose of examining the decision process as a whole I will additionally search for non-Information Systems papers regarding this topic as this might unveil additional valuable insight. For this purpose I will specifically search in the fields of decision theory and psychology using EBSCO Host.

For my literature review I will use a concept-centric approach using an enhanced concept matrix consisting of the concepts BI&A, Success Factor, Decision Making and Success Factor. On the other side of the matrix will be “Definition”, “Different types” and “BI&A for Decision Making”. Once I have finished reading I will synthesize the literature by discussing each identified concept.

I will evaluate the literature regarding content, author and type of publication.

For the success model I will pick an existing one that fits the purpose of this thesis the most. Furthermore, if needed it will be further adapted to fit this thesis.

2. Decision Making

2.1 What is Decision Making?

Decision making can be defined as a cognitive process resulting in the selection of one course of action out of multiple alternative scenarios. The factors affecting decision making can be classified into five major categories:

1. Decision-specific characteristics,
2. Internal organizational characteristics,
3. External environmental characteristics,
4. Decision team's characteristics, and
5. Decision maker's characteristics.⁶

⁶ Nooraie (20012), p. 64 regarding factors 1-4. For factor 5 refer to cognitive simplification process.

Decision-specific characteristics are factors as the complexity and recurrence of the individual decision. Internal organizational characteristics are the cultural aspects as well as the processes and overall internal business environment. The external environmental characteristics comprise everything that is outside of the direct control of the company. The external environment has an influence as decisions can be made because something occurred in the environment or to influence the environment with this decision. The decision team's characteristics are influential because of factors as the knowledge that lies within the team as well as political aims.⁷ The decision maker itself is influenced as each individual of the team is influenced by the knowledge and their personal aims. Additionally, effects like the cognitive simplification process are more or less represented in each individual.

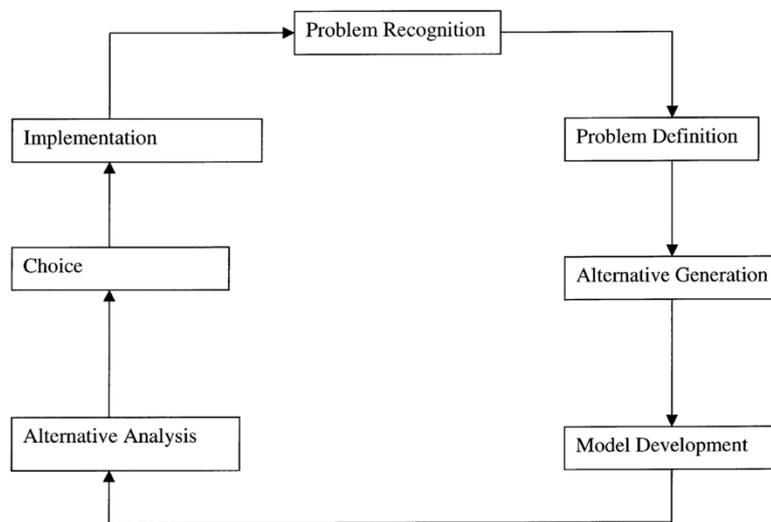


Fig 2-1: The conventional decision making process⁸

Figure 2-1 shows a conventional decision making process that was designed to be easily supported by a business intelligence and analytics system (BI&AS). The process starts with the problem recognition. The different possibilities problems can be recognized is shown in more detail in chapter 2.2. As soon as the problem is recognized it is defined as precise as needed. Then possible alternatives for the decision are generated. Based on that the model is developed determining the analysis of the alternatives. Based on the analysis one of the alternatives has to be picked and implemented. Based on the implementation new decisions probably need to be taken sooner or later.⁹ As it is also

⁷ Refer to knowledge success factors in chapter 6.

⁸ Courtney (2001), p. 19.

⁹ Refer chapter 2.2 about opportunity for decisions.

can be seen in the figure the decision making process can be seen as a iterative circle trying to get from a present state to a desired state and then further enhance what is then the present state.

2.2 Types of Decisions

There can be different kind of opportunities that lead to decisions. They arise from the either environment inside the company or come from the outside. Possible opportunities are missing, and wrong status of specific elements in the current implementation as well threats that have to be measured and in some cases countered.

How decisions should be made depends on the nature and circumstances of the decision. Apart from these four types showing how decisions can arise the management activity itself can be either operational or strategic. As shown in figure 2-2 the main difference lies within the attributes source, scope, level of aggregation, time horizon, currency, required accuracy and frequency of use. This results into completely different relevance of information requirements depending on the decision context.

Characteristics of information	Operational control	Management control	Strategic planning
Source	Largely internal	↔	External
Scope	Well-defined, narrow	↔	Very wide
Level of aggregation	Detailed	↔	Aggregate
Time horizon	Historical	↔	Future
Currency	Highly current	↔	Quite old
Required accuracy	High	↔	Low
Frequency of use	Very frequent	↔	Infrequent

Figure 2-2: Information requirement by level of management activity¹⁰

Another possible classification divides decisions into two major categories: routine and non-routine decisions.¹¹ This scheme is significant because it distinguishes between decisions which must be subject to study and analysis, and decisions which may be made using rules and models to guide the decision maker.

¹⁰ Singh, Watson et. al (2002), p. 81.

¹¹ Compare paragraph to Franklin (2013), p. 29.

Non-routine decisions do not provide a good domain for the application of expertise because they do not recur and it is not possible to acquire experience, which is fundamental in order to improve the expertise.¹² Non-routine decisions require analysis if there is a demand for a high quality result.

Routine decisions do recur and therefore the development of expertise is possible.¹³ Occasionally the application of expertise can be routinized or programmed, as in the case of specifying stocking levels in an inventory system. In other cases the attention of the manager is required in every occurrence. Routine decisions have characteristics that remain largely the same from one occurrence to another making it possible to develop expertise.

2.3 Strategic Decision Making Process

One of the most important executive activities is to be actively engaged in the strategic management process (SMP).¹⁴ The SMP is complex, unstructured and requires inputs from various stakeholders of the organization as well as relevant information to successfully execute it.¹⁵

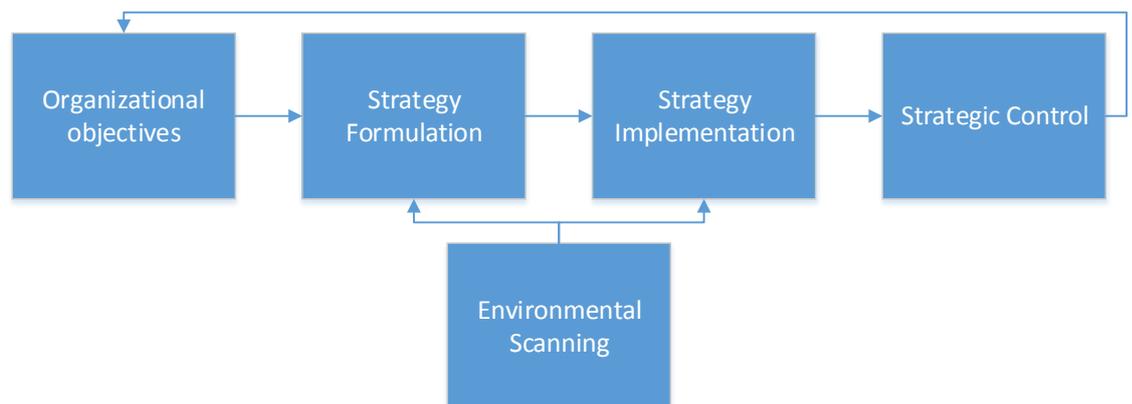


Figure 2-3: The strategic management process

¹² Compare paragraph to Franklin (2013), p. 29.

¹³ Compare paragraph to Franklin (2013), p. 29.

¹⁴ Cf. Singh, Watson, Watson (2002), p. 72.

¹⁵ Cf. Singh, Watson, Watson (2002), p. 72.

For strategic decision making the process can be divided into 5 phases: organizational objectives, environmental scanning, strategy formulation, strategy implementation, and strategic control.¹⁶

In the first step organizational objectives are defined (see figure 2-3). Organizational objectives can be strategic, administrative or operational and form the basis for the overall direction for the organization.¹⁷ Administrative objectives particularize the required organizational infrastructure in order to achieve the strategic objectives. Operational objectives identify specific work tasks that must be performed. Metrics should be developed to measure progress on accomplishing the objectives.¹⁸ In order to obtain the required information, executives rely most heavily on external sources but nevertheless internal sources are also used.¹⁹

The strategic management process continues with the development, evaluation, and selection of strategies.²⁰ Alternative strategies are formulated based on matching the strengths and weaknesses of the organization with the opportunities and threats facing it.

Once strategies are formulated, they must be implemented. Two important activities in this phase hinge on the fact that two major activities are important in this case: the communication of actions to the different participants of the process and the identification of the most suitable persons.

The final phase of the SMP is the formalization and institutionalization of a measurement and control process. A well-defined strategic control system can improve

¹⁶ Cf. Singh, Watson, Watson (2002), p. 71.

¹⁷ Compare paragraph to Singh, Watson, Watson (2002), p. 72.

¹⁸ Cf. Singh, Watson, Watson (2002), p. 72.

¹⁹ Cf. Singh, Watson, Watson (2002), p. 73.

²⁰ Compare paragraph to Singh, Watson, Watson (2002), p. 73.

the probability that the organizational strategies are implemented despite the chaotic, unpredictable, and dynamic nature of an organization's environment.²¹

2.4 Challenge

The difficulties in the process of decision making increase more and more because the viability and success of modern enterprises are subject to the increasing dynamic of the economic environment.²² They have to responsively adjust their policies and strategies in order to respond to sophistication of competitors, customers and suppliers, globalization of business and international competition. It is a significant challenge for the enterprise to extract useful and valuable facts from the mass amount of information in order to gain competitive advantages.

In addition to that, the nature of information itself has changed, in terms of volume, availability and importance.²³ The data complexity concerning structure and semantics grows with high acceleration. The internet, intranets and groupware systems are the main reasons for the strong increase of the volume of available data. Leveraging the value of intellectual property, asset and knowledge, which are included in the enormous crowd of information, is increasingly important in the competitive market.

Apart from the factors explained in chapter 2.5 there is additionally the problem of tunnel vision, which deals with the fact, that a decision maker has a small and restricted view to the problem. This represents the major difficulty in problem identification as it leads to artificially restricting the search for alternatives.²⁴

2.5 Cognitive Simplification Process

As research in cognitive psychology, behavioral decision theory and strategic decision making has shown the decision making process is influenced by several factors.²⁵

²¹ Cf. Singh, Watson, Watson (2002), S. 73.

²² Compare paragraph to Albescu, Pugna, Paraschiv (2008), S. 5.

²³ Compare paragraph to Albescu, Pugna, Paraschiv (2008), S. 5.

²⁴ Cf. Franklin (2013), p. 26.

²⁵ Refer to this chapter, 2.1 and 2.2.

Among the first two research fields are availability, adjustment, anchoring, prior hypothesis and reasoning by analogy.²⁶

Availability

The chronological order of events influences the way people think about their importance.²⁷ Recent events seem to be of higher importance than prior ones which is caused by the fact that recent events are easier to remember and the first to recall from memory. Judgments and decisions made by executives are likely to be biased because they put higher weight on recent experiences.

Adjustment and anchoring

Typical errors that might occur in strategic decision making are often made by executives who rely on past experiences.²⁸ Executives might be prejudiced against new ideas and estimate a certain result based on prior experience which are not current and meaningful. These anchors in the past can lead to false prediction of the future and might let them miss new social trends or technological breakthroughs

Prior hypothesis bias

People tend to interpret information in a way that makes them fit to their beliefs.²⁹ Information that does not fit into their belief is manipulated to not contradict it. On the other hand evidence for their belief is quickly and easily be found. This bias often leads to bad decisions made by individuals ignoring evidences that might have prevented them from making that decision.

The passive presentation of information to executives should not be the only ability of an effective system dealing with the cognitive nature of human beings. It should rather actively engage in the executive's thinking process and provide flexibility and guidance in decision making.

²⁶ Compare paragraph to Chen, Lee (2003), p. 150–151.

²⁷ Compare paragraph to Chen, Lee (2003), p. 150–151.

²⁸ Compare paragraph to Chen, Lee (2003), p. 150–151.

²⁹ Compare paragraph to Chen, Lee (2003), p. 150–151.

Reasoning by analogy

Decisions are often made because of analogy.³⁰ During the process of judgments and decision making it is possible, that uncertainty controls the final decision. In this case, decision makers often compare new problems with past cases or experiences from which useful information, strategies and courses of action can be derived. This process can greatly benefit effective decision making. In addition to that it has been shown, that reasoning by analogy can also be effective in generating creative solutions to problems. However, reasoning by analogy is also problematic. For example, human beings have difficulties to retrieve the required past experiences. The associations between existing circumstances and past events can be inappropriate and misleading at times. Furthermore, strategic decision making involving reasoning by analogy typically involves the application of analogies from simpler situations to complex strategic problems, which helps reduce the uncertainty perceived in the environment.

Overconfidence

Overconfidence can be dangerous.³¹ It indicates that people often misjudge their own knowledge and the requirement for additional information. Many business blind spots can be attributed to the overconfidence of top management. The causes of overconfidence seem closely related to availability, adjustment and anchoring, and prior hypothesis biases discussed above. Recent information or information that can easily be recalled from memory is often the basis for the decision making process (availability bias). When information is abundant, decision makers tend to anchor on prior hypothesis or beliefs and seek confirming information (prior hypotheses bias). These biases might lead to ignorance towards important information or to overconfidence of the decision makers. Furthermore, decision makers have difficulties to consider all possible ways that events can unfold.

³⁰ Compare paragraph to Chen, Lee (2003), S. 150–151.

³¹ Compare paragraph to Chen, Lee (2003), S. 150–151.

3. BI&A

3.1 What is BI&A?

Put in the spotlight by the Gartner Group in 1990s, the term Business Intelligence (BI) covers a variety of information technology (IT)-based tools and approaches helping organizations facing their challenges upon rising amounts of data from internal and external sources.³²

Business analytics (BA) will be used in this thesis as the term that represents the analytical components in BI.

Despite this entry into BI and BA, it is a contentious issue to find a clear definition of what exactly business intelligence and analytics is. As exemplarily shown for the field of DSS in chapter 3.2 both terms are nearly context-free expressions. There are many acronyms especially for BI that are associated with one another. Concluding many various definitions and acronyms can be found for business intelligence in research. Each of these highlights different aspects.

As the term BI&A is context-free the same is true for what is seen as BI&A in practice. Following is an explanation that comprises one possible understanding of the practical usage of BI&A.

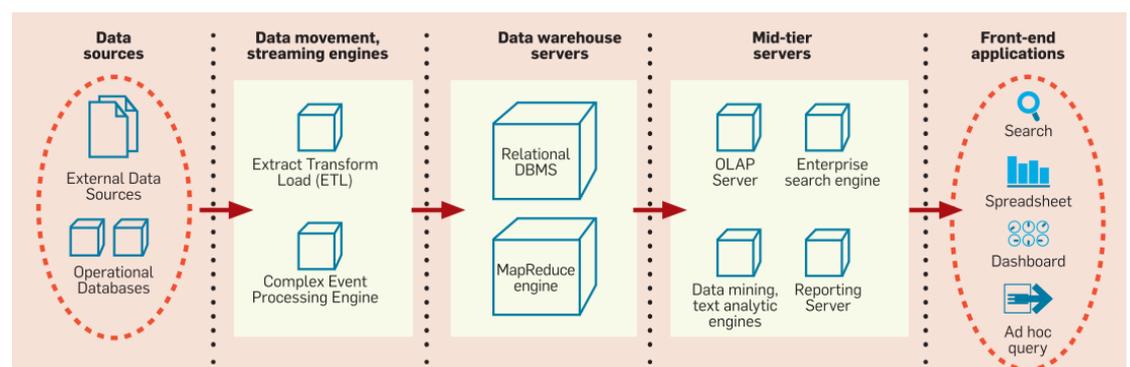


Figure 3-1: Typical BI&A architecture³³

³² Cf. Isik, Jones, Sidorova (2011), p. 161.

³³ Chaudhuri, Dayal, Narasayya (2011), p. 90.

As shown in figure 3-1 the basis lies in the data generated from various transaction processing systems and other information systems being extracted and stored in the data warehouse or data mart. With BI&A tools as data mining, OLAP, DSS analytic), information can be extracted from the data warehouse and passed to the users for their purpose.³⁴ Usually data is visualized in a way to make it easier and more comfortable for the user to get the desired answer.

Initially, reports provided a simple passive overview of current activity and past operation.³⁵ Over time BI&A solutions became a more interactive analysis. The part of BI&A solutions which enables interactive analysis is called Online Analytical Processing (OLAP). OLAP requires the existence of a database and specialists with a high level of qualification. Nowadays this function is integrated in BI solutions that allow business users to interactively analyze data and identify causes of potential problems quick and easy. Queries, reporting and interactive analysis are used to understand and evaluate the past while predictive analysis can provide forecast for the future.

BI&AS provide the possibility to work with other tools that help business operations. Different data warehouses can be adapted into the BI&AS through special interfaces making it possible to integrate further data from different systems supporting further analysis.³⁶

3.2 Types of BI&A

BI as well as BA as a term have lived through a historic development. Nowadays there is a distribution into a number of different Information Systems (IS) with different nomenclature. As already stated in 3.1 it is hard to put strict boundaries between those systems as the definitions are not strict and the boundaries blur depending on which author the focus is being set. For this work BI&A is used as an umbrella term comprising all the IS that are involved in decision making either as a direct support or indirect as for example generating the necessary data structure which decisions are

³⁴ Compare paragraph to Cheng (2012), p. 258.

³⁵ Compare paragraph to Popescu (2012), p. 92.

³⁶ Cf. Popescu (2012), p. 93.

based on. Still the differentiation into systems with different focus is helpful to look at in this context as the success factors also depend on the kind of system being used.³⁷

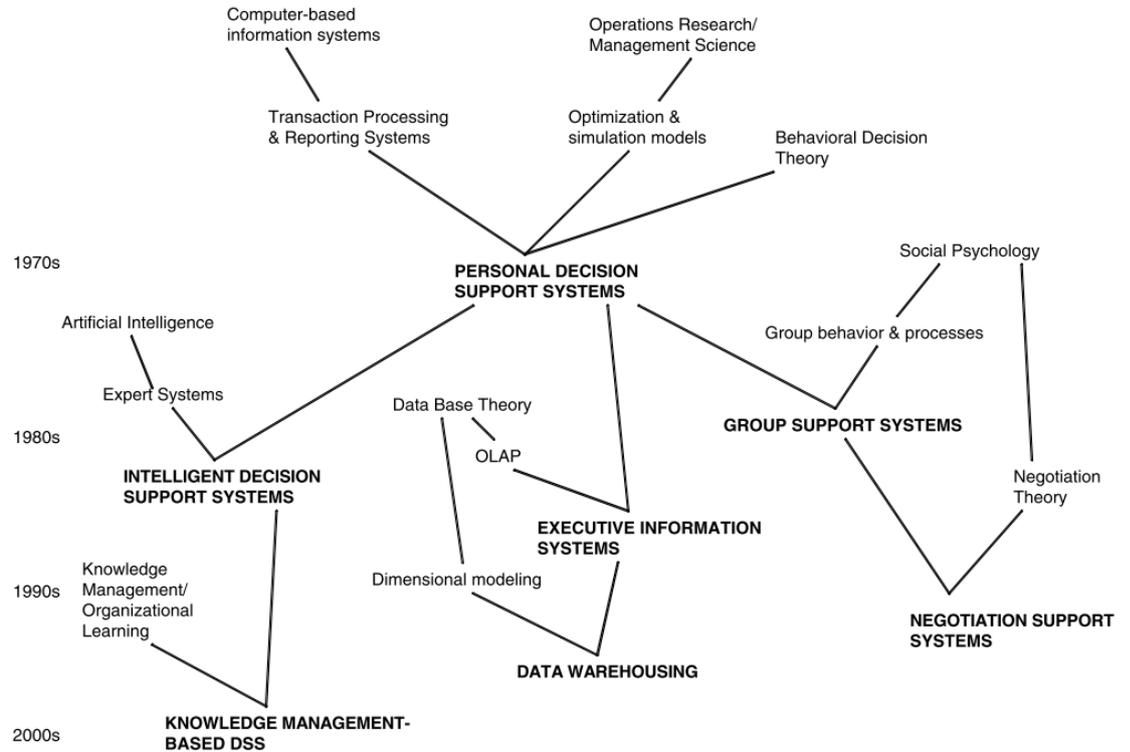


Figure 3-2: Evolution of the DSS field³⁸

Figure 3-2 shows the evolution of the decision support system (DSS) field over time and is one example for the different nomenclature and focus the different BI&AS can have. Noticeable is the wide spread that only one term as DSS has, reaching from artificial intelligence to social psychology and OLAP.³⁹

One possible differentiation between DSS and executive information systems (EIS) against BIS is that those are more application oriented. BIS with a data-oriented approach in combination with data warehousing provide a uniform and integral view on data having the center on representing integral data sources for analytical decision making.⁴⁰

³⁷ See final evaluation.

³⁸ Arnott, Pervan (2005), p. 69.

³⁹ Cf. Arnott, Pervan (2005), p. 69.

⁴⁰ Cf. Popescu (2012), p. 93.

Another term that can be found in research is the term management support system (MSS). These are “computerized systems that support managers in their day-to-day tasks by providing information and decision aids”⁴¹. DSS as well as management information systems (MIS) and EIS are treated as MSS if they provide management support.⁴²

As BI and business performance management (BPM) are often used synonymously a delamination has to be mentioned here.⁴³ BPM is a business process that involves “the processes, methodologies, metrics and technology used to monitor, measure and manage a business”⁴⁴ BI is seen as „business measurement and not business performance management“⁴⁵. Leaving out the “performance” indicates the missing metrics to monitor, measure and change selected business processes under improvement process.

3.3 BI&A for Decision Making

In 2010, BI topped the list of the most important application and technology developments in an annual survey of IT executives.⁴⁶ As BI is stated a top priority for modern businesses it is natural to ask why it is of such importance and how BI can fulfill those expectations.

As already mentioned there is an increasing amount of data from numerous heterogeneous sources being collect by organizations every day. Using BI&AS to collect and analyze these massive amount of data can add great value to a business. Providing decision makers with precise data to the right time allows them to make better decision concluding in putting them ahead of their competitors⁴⁷. The three main

⁴¹ Gelderman (2002), p. 594.

⁴² Cf. Gelderman (2002), p. 594.

⁴³ Bogdana, Albescu, Babeanu (2009), p. 1026.

⁴⁴ Bogdana, Albescu, Babeanu (2009), p. 1026.

⁴⁵ Bogdana, Albescu, Babeanu (2009), p. 1026.

⁴⁶ Cf. Luftman, Ben-Zvi (2010), p. 268

⁴⁷ Cf. Isik, Jones, Sidorova (2011), p. 162.

enablers of BI&AS and concluding crucial for the use and success are technology, people and organizational culture.⁴⁸

Modern BI&AS are able to support the modern leader to draw up strategies for the development of their company to aim and improve their key core competencies.⁴⁹

Another factor that positively catalyzed the growing popularity and cost-benefit efficiency is the significant decline in the cost of data acquisition and storage.⁵⁰ BI&A's data mining capabilities are sought to be able to provide insights on relationships hidden in the data that is valuable for the company putting it further ahead in the competition. The special aim is to search for insights that are hard to see without the help of a suitable tool.

Furthermore, business flexibility and agility often needed in modern markets requires continuous monitoring of the business process and support of a BI&AS.⁵¹ Business flexibility and agility require continuous monitoring of the business processes and support of an appropriate BI&A environment. An environment that provides information sufficiently current to support the requirements for both operational and strategic decision making. BI&A technologies and products are evolving in order to provide such an environment. One trend is to link business process data to operational activity data for a coherent and complete overview on the current business.⁵²

BI&A solutions provide organizations the opportunity to make the best decisions in order to have a better image of business environment.⁵³ Today, the organizations cannot focus on solving problems just at the departmental or functional level in an isolated way. An integrated knowledgebase at organizational level enable to improve access to

⁴⁸ Cf. Cheng (2012), p. 256.

⁴⁹ Cf. Năstase (2010), p. 458.

⁵⁰ Compare paragraph to Singh, Watson, Watson (2002), p. 71.

⁵¹ Cf. Bogdana, Albescu, Babeanu (2009), p. 1028.

⁵² Cf. Popescu (2012), p. 88.

⁵³ Cf. Popescu (2012), p. 88.

everyday decisions. Organizations have to select BI&A tools, easy to use, flexible and allow the user to see that parts of the business he is interest in.

As shown in chapter 2.3 one major process executives are facing is the SMP. Using the support of a BI&A for all five phases is empirically not of success for three of them.⁵⁴ As a result of the study, only organizational objectives and strategy implementation should be put in focus of the BI&AS. For the organizational objects a BIS can help by delivering the executive with the necessary information needed to set up these goals.

For the strategy implementation the monitoring, delivery of information and responsiveness to changing market conditions of the BI&AS greatly enhances the success of this stage.⁵⁵

Important for a BI&AS to consider is the different stakeholders and different types of decisions. As stated in chapter 2.1 and 2.3 decisions can be classified into several categories. For each category there are different requirements that have to be fulfilled by the BI&AS as well as the importance of the relevant factors differ for each category. Therefore it is important to be aware of the different needs and usage in practice. However, when taking the needs of routine vs. non-routine and operational vs. strategic into consideration it is clear that they are not contradicting each other. Concluding it is possible to fulfill the needs of all end-users with the BI&A system. Yet, it is another question if it is worthwhile to fulfill all the needs of all end-users and not focus on one group more specific.

3.4 BI&A for Decision Making limitations

There are several occasions where BI&A hits the limit of what is possible with an IT system nowadays.

⁵⁴ Cf. Singh, Watson, Watson (2002), p. 72.

⁵⁵ Cf. Singh, Watson, Watson (2002), p. 72.

Every so often it comes to the point that the decision that needs to be made is depending on an environment that is highly dynamic or unstable.⁵⁶ Thus it is hard for modern BI&A systems to compensate this in their calculations. Still the system might be of help for the decision maker as a basis or to gather additional information the decision maker seems to be important to make the decision but still the support of the BI&AS is very limited in these situations.

Another factor is another one about the decision environment the decision is held in.⁵⁷ In some cases, especially when it comes to decisions that are highly influenced by psychological or behavioral variables it is impossible to generate a sufficient decision environment. The causal relations, human psychology and behavior is far too complex to be taken into consideration in any good quality. Despite this fact of a simple lack of understanding and knowledge on these variables there are no measurable variables that can be used to bring those factors into the decisions. It might be possible to create proxy variables that are used as indicators trying to comprise what is too complex to calculate but the quality of these is disputable.

A third factor is computational complexity.⁵⁸ Despite the potential power of modern BI&AS there are problems that remain too large to be calculated. Either the problem itself is too large or required decision interval is too short for the BI&A. When considering Moore's Law this might be solved in the more or less distant future but for now this comprises a boundary that is insuperable in some cases.

4. Success Factors

4.1 What is a Success Factor?

For this thesis a success factor is defined as a factor that can be aimed to achieve or improve to positively influence one or more of the success dimensions in the given context. This influence can be of a direct or indirect character. In this thesis there will be

⁵⁶ Cf. Franklin (2013), S. 31.

⁵⁷ Cf. Franklin (2013), S. 31.

⁵⁸ Cf. Franklin (2013), S. 31.

no distinction between the term critical success factors and success factors as there is no ranking between the success factors derived.

4.2 Success Model

Finding and measuring the success of a BI&AS is a tough problem in practice as it is for any IS due to the paradigm of the uncertainty in how far IT contributes to the success of a company.

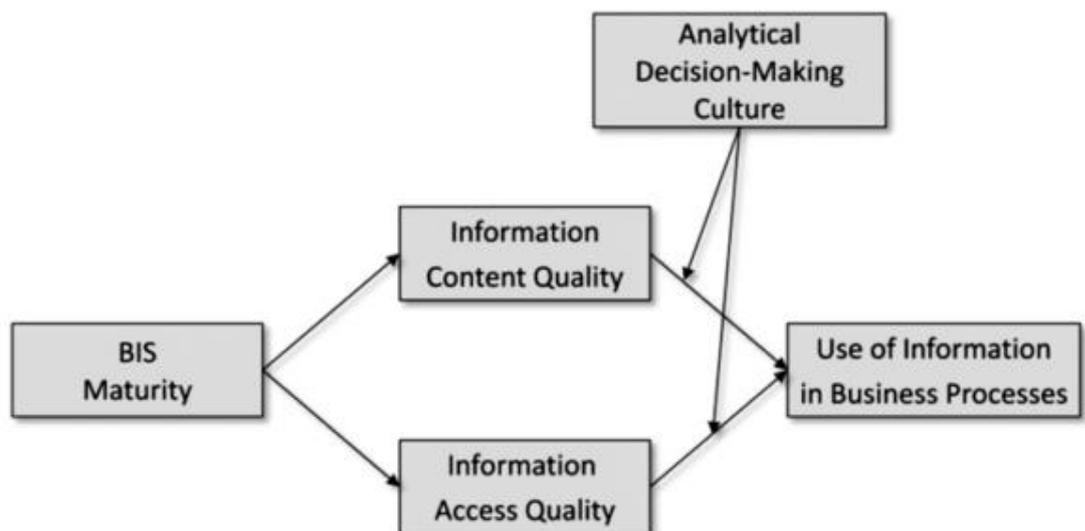


Figure 4-1: Success Model⁵⁹

For this thesis the BI&A success model of Popovič et al. 2012 is used. This model identifies 5 factors directly or indirectly determining the success of a BI&AS. Its main point is that success is determined by capturing the value of information along the information value chain. If organizations want information to contribute to their success it must be used within business processes to improve decision making, process execution or ultimately to fulfill consumer needs. BI&A maturity refers to “the state of being fully developed and a maturity stage refers to a succession of changes that affect an entity”. In other words it is determined by the integration of large amounts of data from heterogeneous sources within the BI&A and the provision of analytical capabilities. Consequently when BI&A maturity raises the IQ, especially the

⁵⁹ Popovič et al. (2012), p. 730.

information content quality, is positively affected.⁶⁰ A BI&A contributes to improved information quality (IQ) split up in information content quality (information relevance) and information access quality (features related to information access). The final factor that is the only direct factor for success is the use of information in business processes. This factor is determined by the IQ in context of the analytical decision making culture.⁶¹

As “Use of Information in Business Processes” is too abstract for practical purposes, 7 direct success factors are provided.⁶² Each success factor shown in chapter 5 is positively affecting at least one of these factors in a direct or indirect way.

“The available information within our organization's business processes ...

UI1 ... exposes the problematic aspects of current business processes and makes stakeholders aware of them.

UI4 The information reduces uncertainty in the decision-making process, enhances confidence and improves operational effectiveness.

UI5 The information enables us to rapidly react to business events and perform proactive business planning.

UI6 We are using the information provided to make changes to corporate strategies and plans.

Through managing the organization's information, we are ...

UI7 ... adding value to the services delivered to customers.

UI8 ... reducing risks in the business.

UI9 ... reducing the costs of business processes and service delivery.”⁶³

In order to give a complete view about how to maximize the use of information business processes when not only decision making is in focus the remaining factors are listed here as well:

⁶⁰ Popovič et al. (2012), p. 731.

⁶¹ For further information about how decision making culture affects the use of information refer to the culture factors in chapter 5.

⁶² These factors were derived by Hackney and are reduced here to fit the smaller context of this paper.

⁶³ Popovič et al. (2012), p. 734.

“UI2 ... provides a valuable input for assessing business processes against standards, for continuous process improvement programs, and for business process change projects.

UI3 ... stimulates innovation in internal business processes and external service delivery.

UI6 We are using the information provided to modify existing KPIs and analyze newer KPIs.

Through managing the organization's information, we are ...

UI7 ... adding value to the services delivered to customers.

UI9 ... reducing the costs of business processes and service delivery.”⁶⁴

5. Success Factors for BI&A for decision making

5.1 Overview

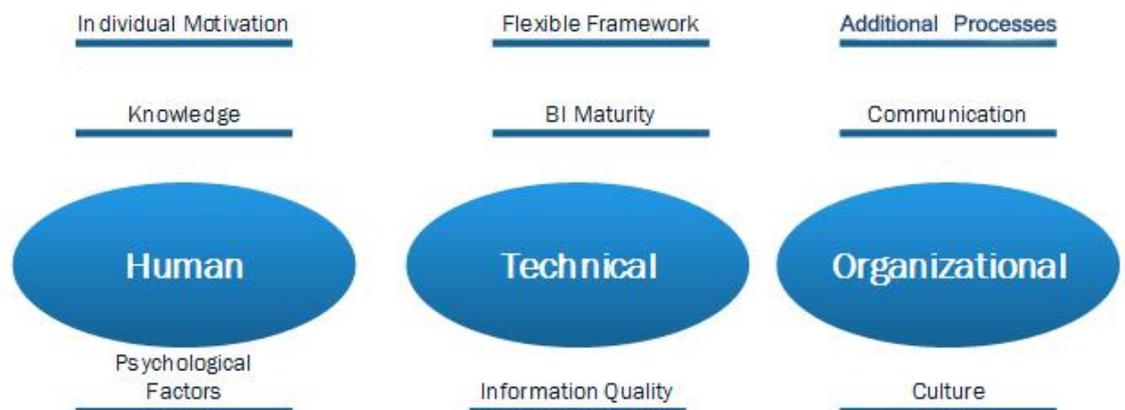


Fig. 5-1: Overview

As already Popovič et al. (2012) found out, the three main enablers of BI&A and concluding crucial for the success of the BI&AS are technology, people and organizational culture.⁶⁵ This thesis is supported here since as a result of gathering and clustering the success factors these three main category emerged.

⁶⁴ Popovič et al. (2012), p. 743.

⁶⁵ Cf. Cheng (2012), S. 256.

Human factors are factors that deal with human behavior and knowledge. They mainly describe how people in the organization should deal with knowledge about the BI&AS and how human psychology is effecting the success of the BI&AS in a direct or indirect way.

Overall, the proper understanding of the BI&AS of all relevant participants in the company is one key issue here. As more knowledge is created and transferred within the artificial boundaries within a company the effective use as well as proper understanding of what BI&A can do and what it cannot is leveraging the success.

As shown in chapter 2.5 the cognitive simplification process is helpful to look at when it comes to the question of how decision makers have to be supported in a correct way to diminish the imperfect human nature as well as helping them making the best out of the positive factors of the cognitive simplification process.

The technical factors are factors that are directly related to the technical framework, quality and maturity. These factors can mostly also be used as success factors for the implementation of a BI&AS nevertheless are important to obtain or maintain during usage.⁶⁶

The realized use of information in business processes is dependent on the Information Quality which is influenced by not only the methods used to obtain and restrain the data and present it to the user but having also a good integration of different data sources. One important delimitation to mention is that information access quality in comparison to the information content quality is not as far as relevant. The factor of a flexible framework which has the strongest background from the implementation and pick of the BI&AS is relevant when it comes to change management and living the process within the company.

The last category comprises organizational factors. As BI&A systems are having a high impact on organizational level it must be steered by management to not face

⁶⁶ See final evaluation for more critical point of view.

insurmountable resistance in many layers of the company. Management support especially from top management can be seen critical here but resistance from lower hierarchies can be negatively influencing the success.

Communication plays a role here finding and diminishing possible resistance as well as accelerating the knowledge transfer within and outside the company. For the idea of the BI&AS to be one big system comprising much of the knowledge and decision power it accelerates diminishing the boundaries between the horizontal and vertical sections within the company.

Quality governance as a process to be introduced for BI&AS if not already existing is a pure indirect factor influencing the perpetuation and improvement in quality leveraging the decision quality at the end.

Cultural aspects are further indirect and direct factors influencing the success. A BI&AS can propose the best and powerful solutions to the decision maker but still it depends on the user to use this information the right way. It may be true that intuition is helpful in a decision making context, still the risk of factors as example overconfidence is there. The other dimension is the collaborative culture in the company. This is nearly superimposable with the factors of communication but can be controlled in different matters.

As already stated at some points here there is a high amount of interdependencies between the subcategories of each category. Analyzing all interdependencies would have been gone too far for this first line up of success factors but some are used to explain the impact of a success factor more clearly.

Although many of the factors are applicable for the implementation project of a BI&A the focus of this success factors lies within the use of the BI&AS for decision making. There have been many studies about success factors for IT projects and further analysis of failures. Although there may be specific BI&AS implementation project success factors these are not in the focus of the here listed success factors. Many factors, especially the technical and organizational ones can or must often be handled in the

implementation phase but still they have to be obtained or enhanced to improve the success of the BI&AS.

5.2 Human Factors

Knowledge

Success Factor (SF)	Source(s)
Proper understanding of IT	Empiric: Teo, Ang 1999; Poon, Wagner 2001 Various: Hartono, Santhanam et al. 2007
Existence of business champion	Empiric: Poon, Wagner 2001
IS management proper understanding of business	Empiric: Teo, Ang 1999; Rainer, Watson 1995
Training for end-users	Various: Hartono, Santhanam et al. 2007 Empiric: Bajwa, Rai et al. 1998; Hejazi, Yazdanpanah et al. 2011; Woodside 2011
Right BI team	Empiric: Rainer, Watson 1995; Poon, Wagner 2001; Yeoh, Koronios, Gao 2008

Tab. 5-1: Knowledge

Proper understanding of IT

In order to use the BI&A at the full potential users have to become experts in their field. Additionally, it is important to have business domain experts, especially for such activities as data standardization, requirement engineering, data quality analysis, and testing.⁶⁷

Seeing it from a top management point of view it is important that they are knowledgeable of IT to be able to objectively evaluate proposals for purchase or upgrade of hardware and software. Also, this positively influences the ability to evaluate payoffs from further investments in the existing or a new BI&AS having more realistic expectations of the outcome of this investment. Every so often IT is seen as panacea for all organizational problems, but it's not.⁶⁸

⁶⁷ Cf. Yeoh, Koronios, Gao (2008), p. 88–89.

⁶⁸ Cf. Teo, Ang (1999), p. 182.

Existence of a Business Champion

A business champion is someone who “understands the business and the technology and is able to translate the business requirements into a (high-level) BI architecture for the system”⁶⁹. The existence of at least one of these champions is critical for implementation success but also during the lifecycle of an active BIS. The champion can foresee the organizational challenges and is able to change the course accordingly. Additionally, this business-centric champion is viewing the BIS primarily in a strategic and organizational perspective which is of more success than over-focusing on technical aspects.⁷⁰

IS Management is knowledgeable about Business

The extent of IT deployment in business strategies, value chain activities as well as aligning business and IS planning is highly influenced by the business competence of the IS executive. Business competence includes business knowledge based on internal knowledge as business strategies and processes as well as environmental knowledge about strengths, weaknesses and potential actions of competitors. Concluding it is important for IS management to not only focus on the technical aspects of the BI&AS but on how to exploit IT strategically for their decision making. The main focus here should be laid on strategic objectives and implementation.⁷¹ Additionally, this affects the reputation of the IS to be more business-focused which may conclude in a higher acceptance and support of top management.⁷²

Training for End-users

⁶⁹ Cf. Yeoh, Koronios, Gao (2008), p. 88–89.

⁷⁰ See organizational success factors.

⁷¹ Refer to chapter 2.3 and 3.3 regarding SMP

⁷² Cf. Teo, Ang (1999), p. 179.

Training general BI&A concepts as well as the proper use of the specific used BI&A is important to generate basic knowledge that might be lacking from an IT point of view, inexperience of the user with BI&A in general or with the specific BI&AS. Training should include process changes, overall flow of information, standards and policies that can be followed to optimize the use of the BI&AS. New users should be required to take established training and existing users on an annual basis and directed to the training materials as questions arise.⁷³

Right BI Team

Having the right composition and skill set of a BI&A team does have a major influence on the implementation success of a BI&AS. However, this is true for live use as well. The team should be cross-functional and composed of personnel with technical expertise and others with strong business background. This is important as a BIS is a business-driven IT system providing support for managerial decisions. Therefore a suitable mix of IT expertise for the technical aspects and business expertise for reporting and analysis aspects is important.⁷⁴ Furthermore, the BI&A team must include business domain experts, especially for such activities as data standardization, requirement engineering, data quality analysis, and testing.⁷⁵

Individual Motivation

SF	Source(s)
Management of resistance	Empiric: Rainer, Watson 1995; Poon, Wagner 2001
Individual motivation	Empiric: Rainer, Watson 1995; Hejazi, Yazdanpanah et al. 2011 Various: Hartono, Santhanam et al. 2007
Individual satisfaction	Empiric: Rainer, Watson 1995; Hartono, Santhanam et al. 2007; Hejazi, Yazdanpanah et al. 2011 Various: Hartono, Santhanam et al. 2007

Tab. 5-2: Individual motivation

⁷³ Cf. Woodside (2011), p. 559.

⁷⁴ Cf. Yeoh, Koronios, Gao (2008), p. 88–89.

⁷⁵ Cf. Yeoh, Koronios, Gao (2008), p. 88–89.

Management of Resistance

Resistance can be executed in several ways. Individuals can refuse to communicate or align with the collaborative culture making a company-wide BI&A approach harder to obtain.⁷⁶

One possible reason for resistance is the lack of interest of individuals working on an organizational level giving up their power and revealing the performance open for everyone with access to the system.⁷⁷ Other issues can occur because of political power fights as internal problems are exposed and presented.

Individual Motivation

Individual motivation can be considered as an intuitive success factor. If the individual decision maker is not motivated in using the BI&AS it is clear that the BI&AS has nearly no influence on the decision making of this individual. Hence he will either get back to the methods used before or may try some form of resistance.

Individual Satisfaction

Individual satisfaction is an indirect success factor that positively influences the analytical decision making culture. As this factor highly depends on the given organization this success factor has to be always critical. Nevertheless empirical studies stated these to be success factors of BI&A.⁷⁸

Psychological Cognitive Factors

SF	Source(s)
----	-----------

⁷⁶ Cf. Woodside (2011), p. 559.

⁷⁷ Cf. Woodside (2011), p. 559.

⁷⁸ Refer to table

Support introspective	Theoretical: Chen, Lee 2003
Support retrospective	Theoretical: Chen, Lee 2003
Support prospective	Theoretical: Chen, Lee 2003

Tab. 5-3: Psychological factors

Based on chapter 2.5 about the cognitive simplification process three additional success factors can be derived. It must be said that those could be aligned as well under the BI&A maturity factors but it is important to create the awareness of these factors on their own. Analytical methods can be supplied to support the retrospective, introspective and prospective but there might be other approaches supporting these factors. For example it could be helpful for individuals to create an individual visualization of their best working processes helping them remember these when it comes to other processes or projects. Furthermore, individuals can ask their selves in how far they depend and use the different dimensions of support that can be obtained from the BI&AS as well as from other sources in the company in their decision making. It may be just needed to create the awareness to trigger a self-evaluating thinking process.

Support Retrospective

In order to reduce availability bias, imperfect memory and aid analogical case creative thinking a case memory functionality can be the one to choose.⁷⁹ Bringing up older cases with sufficient support of the BI&AS can enhance the information content quality the decision maker can use for the basis of his decision.

Support Introspective

Having a look at the introspective and reflect on and examine the assumptions and belief system grants possible aid to surface and examine explicit and implicit assumptions, overcome blind spots and increase self-assurance.⁸⁰ A method that can be provided by the BI&A is cognitive mapping.

Support Prospective

⁷⁹ Cf. Chen, Lee (2003), p. 158.

⁸⁰ Cf. Chen, Lee (2003), p. 158.

When trying to envision future state of business environments and understand possible consequences of decisions a BI&A systems' capability to provide these by scenario building possibly reduces overconfidence, anchoring effects, availability bias and change the frame of reference.⁸¹

5.3 Technical Factors

Flexible Framework

SF	Source(s)
Customization	Empiric: Rainer, Watson 1995; Poon, Wagner 2001 Delphi Yeoh 2008; Hejazi, Yazdanpanah et al. 2011; Woodside, Joseph 2011

Tab. 5-4: Flexible framework

Customization

As the business environment changes the requirements for IT systems change. No matter how good the initial quality of a BI&A is for the current business environment it was built for it is essential that it can respond or is at least flexible enough to align with the changes accelerating the company's reaction to market and business changes.⁸² Important to note is the knowledge that is needed after and before these customizations. Depending on the severity of the customization users must be aware of how to use the system properly after it has been customized. As the technical framework that is essential for the ability of the BI&S to be customized is picked before the implementation stage there is not as much that can be done to change this without enormous costs. However it is possible to expand the BI&S with additional software if needed. This may work as a work-around helping to aid a possible inflexible framework when it seems to be too late.

⁸¹ Cf. Chen, Lee (2003), p. 158.

⁸² Cf. Woodside (2011), p. 558.

BI&A maturity

SF	Source(s)
Information quality	Empiric: Singh, Watson et al. 2002 Emp. Popovic, Hackney et al. 2012; Poon, Wagner 2001; Yeoh, Koronius, Gao 2008; Hejazi, Yazdanpanah et al. 2011
Analytical capability	Empiric: Rainer, Watson 1995; Popovic, Hackney et al. 2012; Hejazi, Yazdanpanah et al. 2011 Theoretical: Popescu 2012

Tab. 5-5: BI&A maturity

BI&A Maturity

Data integration and Analytical capabilities are two significant dimensions of BI&A maturity. For organizations striving to reach higher levels of BI&A maturity it is necessary that they first solve data integration issues. These can be data quality and security issues, metadata management issues, lack of IT data integration skills, data transformation and aggregation issues. However, it is the introduction of advanced analytical technologies, such as OLAP, data mining, and dashboards that enable reaching higher levels of maturity which significantly contribute in advancing BIS from low-value operations to strategic tool.

BI&A maturity has a significant positive impact on both segments of IQ, namely Information content quality and Information access quality.

Information Quality

BI&A is concerned with knowledge-intensive activities. Therefore it is essential on which knowledge the decisions are based on. ⁸³Data that is being corrupt, incorrect or incomplete is leading to problems that directly influence the decisions being made based on these. Furthermore, low IQ leads to higher dissatisfaction of end-users with the BI&AS as the results are not as good as they could be and individuals are more likely to return to their previous decision making. Additionally, less suitable and acceptable data quality drives the whole process into a vicious-circle as data generated from this data is of lower quality as well. As already stated before it is essential to focus on the content

⁸³ Popovič et al. (2012), p. 740-742.

quality rather than the access quality of the information. When information is needed it is more important to get the information needed in any possible way despite the unusual great time it may need to access and collect the data that is being needed. This can be due to the fact that information may not be available through other channels within the company. It may also be the case that information can be gathered through others channels but it is in the end far more costly so lower access quality is more accepted and less critical when it comes to decisions.⁸⁴

BI&AS have to be working with all kinds of data needed for the analysis.⁸⁵ Having no differentiation in importance between the different kinds of data such as numerical and non-numerical data it is important to attach the same level of data quality for all these factors. However, in practice some focus on leveraging the IQ of specific types of data which might be a factor influencing the success of their BI&AS. More research is needed here in how far this factor is of what level of relevance determining the success of a BI&AS.

An additional requirement indicates that the quality of data of the source system is depending on the ability of the BI&A to integrate all different kinds of data sources within the enterprise.⁸⁶⁸⁷ Thus corporate data is only at its best value once these data sources are fully integrated within the company and quality and integrity are assured.

5.4 Organizational Factors

Culture

SF	Source(s)
Management support	Empiric: Teo,Ang 1999, Emp Singh, Watson et al. 2002; Rainer, Watson 1995; Poon, Wagner 2001; Woodside; Bajwa, Rai et al. 1998; Delphi Yeoh 2008 Various: Hartono
Analytical decision	Empiric: Teo,Ang 1999; Popovic, Hackney et al. 2012

⁸⁴ Cf. Popovič u. a. (2012), p. 737.

⁸⁵ Cf. Yeoh, Koronios, Gao (2008), p. 0–91.

⁸⁶ Cf. Yeoh, Koronios, Gao (2008), p. 90–91.

⁸⁷ Cf. Albescu, Pugna, Paraschiv (2008), p. 5.

making culture	
Collaborative Culture	Empiric: Teo,Ang 1999;Woodside

Tab. 5-6: Culture

Collaborative Culture

Strongly related and influencing the communication success factors is the extension of a collaborative culture within the company. Shared visions and teach ability influences the collaborative culture the most. In order to achieve a well working collaborative culture the team work and alignment between units in support of a common objective and set of goals have to be strengthened.⁸⁸

Analytical Decision Making Culture

Analytical decision making culture describes a culture that has been integrated into an organization or has developed throughout the years.⁸⁹ It is characterized by a high importance and value for analysis and decisions based on these analysis. It can be said that this culture focusses on a more rational and data-driven decision level.

An analytical decision making culture diminishes the decision makers' perception of the relevance of information content quality for the use of information in the business processes.⁹⁰ The influence of analytical decision making culture on the success, especially on the information content quality is complex. Organizations with a high level of analytical decision making culture are not as dependent on the quality of the information that is delivered. Decision makers then use the currently available information that is in the business processes of the company.

Organizations with a low level of decision making culture highly benefit from the improvement of content quality whereas this cannot be said is always true for organizations with a high level of decision making culture.⁹¹ Anyways the influence of

⁸⁸ Cf. Woodside (2011), p. 558.

⁸⁹ Cf. Popovič u. a. (2012), p. 737.

⁹⁰ Cf. Popovič u. a. (2012), S. 737.

⁹¹ Cf. Popovič u. a. (2012), p. 737.

decision making culture on IQ is there but it cannot be clearly said that it is always negative or positive.

Communication

SF	Source(s)
Vertical communication	Empiric: Teo,Ang 1999; Emp Singh, Watson et al. 2002; Bajwa, Rai et al. 1998; Hejazi 2011
Horizontal communication	Empiric: Teo,Ang 1999; Singh, Watson et al. 2002
End-user communication	Empiric: Teo,Ang 1999
External/Consultant communication	Empiric Rainer, Watson 1995; Bajwa, Rai et al. 1998; Hejazi 2011

Tab. 5-7: Communication

Vertical Communication

Vertical communication is one of the main dimensions communication can be distributed in. As seen in the SMP there are phases as the strategy implementation where it is important to establish a communication between the higher management level and the operational level.

Decisions that are perfectly made and based on highest quality data can still fail when it is not implemented correctly in the operational level and through the vertical lines of the organization. Communication processes should be established and information shared across the vertical boundaries.⁹² This allows knowledge to be spread among the organization and not be concentrated on one spot where people who need it don't have access to it. This is one factor that is very important during an implementation process but as argued before still is accelerating success during the use of the BI&AS. One possible process that can be established to maintain a well operating communication between the layers is to organize recurring meetings where information about the current progress, status and problems is shared among all participants. Participants in this case should be coming out of all vertical layers.

⁹² Compare to Woodside (2011), p. 558.

Horizontal Communication

Also concluding from the need of IS management to know about business as well as top management to know about their IS and IT communications on a horizontal level is important for the success of the BI&A.⁹³ IS management has to bring their IS plans together with the business plans of top management resulting into a better competitive situation in the market for the company. In order to have the IS management as well as top management make the right decisions they need to communicate to aim at the same direction. Without a deeper communication organization may become inefficient regarding their internal IT as well as using IT as a competitive advantage.

End-user Communication

This factor could also be seen as included in the previous two factors but nevertheless is stated here to specifically emphasize the need of communication to the end-user.⁹⁴ Frequent communication between the user and IS department is necessary for continuous improvement of the use the BI&AS. At the same time they build a communication basis where problems and success stories can be shared and used as valuable input to positively influence the work of the IS department and at the end of the user itself as he and his needs are recognized within the process. On the other way around IS department is becoming more aware of the current business and can align their decisions and approaches upon these.

External/Consultant Communication

External consultants play a role helping in the process of improving and establishing the BI&AS.⁹⁵ They are especially helpful in the beginning of the process as they have the knowledge that is missing or rare in the company. Communication with consultants complements arising knowledge issues as well as providing additional other benefits. As stated in the human factors there is the problem of resistance within the company which is often influenced by political reasons. Consultants are impartial and out of the influence of political circumstances within the organization. They can provide the

⁹³ Cf. Teo, Ang (1999), p. 181.

⁹⁴ Compare paragraph to Teo, Ang (1999), S. 180.

⁹⁵ Compare paragraph to Teo, Ang (1999), S. 180.

unbiased view that is needed to solve problems with as well as helping executing the decisions made.

Additional Processes

Success Factors	Source(s)
Business user-oriented change management	Empiric: Rainer, Watson 1995; Poon, Wagner 2001; Delphi Yeoh 2008
Data Quality Governance	Empiric: Rainer, Watson 1995; Delphi Yeoh 2008
Clear link to business vision	Empiric: Teo,Ang 1999; Poon, Wagner 2001

Tab. 5-8: Additional processes

Business User-oriented Change Management

User participation in the change management can lead to better communication of their needs.⁹⁶ Data, methods, problems and others needs are best known by those who have these artifacts. Involving them into the change management processes not only gives the organization a better feedback on what is exactly needed by the end users but it can enhance the knowledge of the users about their organization.

Another point to consider is user acceptance through participation in change management.⁹⁷ When users are given the chance to participate and express exactly what they need a much higher acceptance can be expected. This can even go so far that users are setting the goals and circumstances that determine what exactly and how changes have to be completed giving them much power. Thus users create a sense of ownership.

However, there is always the risk that end users act according to the principal agency theory and therefore seek to guide the changes in directions that make themselves feel comfortable but is not effective in terms of continues improvement of processes and the included decisions.

⁹⁶ Compare paragraph to Yeoh, Koronios, Gao (2008), p. 87.

⁹⁷ Compare paragraph to Yeoh, Koronios, Gao (2008), p. 87.

IS departments shall be responsive to serve users need making it less probable that Being responsive to user needs makes changes to the BI&A more likely to be viewed as important and useful.⁹⁸ Hence, the acceptance and satisfaction rises. Furthermore it contributes to a collaborative culture and communication among different sections of the organization.

Data Quality Governance

As the data quality of a BIS is crucial for its success it is also important to establish and continually enhance data quality governance.⁹⁹ It should include a governing committee, a set of procedures and an execution plan ensuring that data quality is not only sufficient at the start but throughout the lifetime of a BI&AS. Meanwhile, a set of policies and audit procedures must be put into place that ensures ongoing compliance with regulatory requirements as most like utilities are public-owned company.

In order to achieve a consistent and sustainable quality governance it is necessary to create a coming basis of understanding.¹⁰⁰ In practice accurate data has been captured at the source level but is not linked to other data sources due to inconsistencies. The wide spread of different people having different approaches and styles how they manage and visualize their data leads to a problem when trying to enhance the data quality. It may be sufficient at the start and all decision makers are happy with their best of breed solutions but over time this concludes into masses of non-high quality reports and analysis in the system. To reconstruct these areas is a huge issue and project that could have been prevented by deciding on beforehand how reports and analysis are to be structured. This can be done my sorts of master data set that are given to the employees making them likely to align with the rules given in the business and in their quality governance. At the end the spread is declined and overall quality and efficiency is improved.

⁹⁸ Compare paragrahp to Teo, Ang (1999), p. 182.

⁹⁹ Compare paragrahp to Yeoh, Koronios, Gao (2008), p. 90–91.

¹⁰⁰ Cf. Yeoh, Koronios, Gao (2008), p. 90–91.

What is needed for these master data sets is a business-led commitment and prioritization. ¹⁰¹As a BI&A is always business-driven it is important to have individuals having high business knowledge as well as people from IT preparing those sets to not make mistakes that affect all users of this sets having a bad basis for the wanted quality improvements. Additionally, it creates confusion in the organization of what actually is the current state of the art that they should use for their operations.

The combination of the BI&A with the higher quality governance and the expected higher use of the user and control of the spread is what is leading to the success here.

Clear Link to Business Vision

This success factor can be derived looking back at the SMP as well as the need for communication among the vertical but especially the horizontal communication. As already stated and explained in more detail in chapter 2 and 3 BI&A systems are used to support the decisions made by the managers that want to get from the present state to the desired state. Therefore it would be inconsequent to put a high importance on high quality data leading to high quality decisions when the picked decision would just be followed as individuals effected by the decision please it the most. Concluding, it is important to have decisions on strategic as well as operative level having a clear link to the business vision or in other words the strategy that has been developed and decided to be the right one.

6. Final Evaluation

First of all a reflection on what has been achieved in this thesis: The success factors that have been collected and categorized all have at least one source of proof. This is due to the way the success factors have been collected. Anyway this does not mean that the success factors can be totally contradict free. As human psychology and decision theory are complex and especially in combination with BI&A not fully researched it leaves open questions in these fields which answers could contribute to underline the findings here. For the sources of the success factors it can be said that nearly all have been using empirical methods to derive their success factors. Consequently, this may lead to the

¹⁰¹ Cf. Yeoh, Koronios, Gao (2008), p. 90–91.

fact that all found out mostly similar success factors giving away the potential to find new unknown success factors. This is one of the reasons this paper also focused on decision theory in its form of the cognitive simplification process. The three generated success factors may be not surprising but still show where concept as cognitive decision support systems are leading to.

The success factors can more or less easily be used for practice as a checklist for upcoming or ongoing BI&AS. It was not intended to be the most precise success factors as panacea for all BI&A solutions that are available on the market for all types of companies. It shall be used as an entry for decision makers starting into analysis how well they roughly do in their company. Depending on greater problems that are identified or simply the awareness that some points of this checklist were not recognized enough in their current company they can start going into more precise literature on how to actually achieve improvement.

In my opinion it is important to supply decision makers in this context of BI&A with the big picture of all the factors that contribute to the failure or success of their BI&AS. Having the big picture allows to rate and put specific factors in relevance to each other as well as expanding the boundaries that might have been created artificially in their job.

For each individual there are two sides on how to evaluate these factors. The first question should be how the individual can contribute to the success factors. The other question should be how the individual can help others contributing to their success factors. An example would be an IT management staff that is continually getting information about business plans and strategies and thus is perfectly able to align there IS plans with the business plans but they don't communicate their IS plans and discuss with the management about them. The potential that is given away here is the enhanced knowledge of the management staff itself. With greater knowledge from the IT side business planning may include IT in a completely different way making the company better compete in business and therefore the decision that was made turned out to be of greater quality.

Another important thing to keep in mind is that the decision making process itself is an iterative circle. This has to be kept in mind when running the BI&AS.

Having a look at the success factors and their overall structure it is true what is anticipated at first. BIS is influenced by many factors that could generally be used for many IS systems.¹⁰² What makes a huge difference to other IS when looking at BI&AS and leverages the success of it is having a close look at the decision making culture as well as human psychology, especially the described cognitive simplification process.

One of the major points to scrutinize is in how far pure implementation factors are important during the lifetime of a BI&AS. It may be depending on the flexibility of use because small iterates can be seen as small BI&AS projects fulfilling the needs of typical IT project as well as the specific BI&A factors. Furthermore, it is critical to use success factors from the implementation of the system as success factors for the use of the system without careful consideration of the relevant contextual issues¹⁰³.

Due to the size of the topic of this thesis it is limited in many ways. The gathered success factors are focusing on BI&AS for strategic decision making. What is missing is a more clear distinction between strategic and operative decision making as well as a distinction between the different BI&AS. Furthermore, the distinction between routine and non-routine and or between different kinds of opportunities that lead to decisions can be valuable. In this context it has to be named that precise rankings of the importance of different success factors were next to impossible to generate within this thesis.

¹⁰³ Cf. Yeoh, Koronios (2010), S. 31.

System types	Rankings	Independent variables (success antecedent categories)	Aggregate Pearson's correlation-coefficients
Data Warehouse	1	System development characteristics	0.288
	2	Management support	0.258
	3	Organizational characteristics	0.244
	4	System characteristics	0.146
	5	User participation	0.145
Decision Support-System	1	User perceived benefits	0.363
	2	User training	0.251
	3	Management support	0.217
	4	User experience	0.194
	5	User participation	0.131
	6	Organizational characteristics	0.124
	7	Task characteristics	0.040
Executive Information System	1	Management support	0.32
	2	System characteristics	0.168
	3	Organizational characteristics	0.167
	4	System development characteristics	0.058
	5	User experience	0.040
Expert System	1	User experience	0.5
	2	System development characteristics	0.345
	3	User perceived benefits	0.254
	4	User participation	0.253
	5	Task characteristics	0.19
	6	Management support	0.108
Group Support-System	1	Task characteristics	-0.61
	2	User participation	-0.029
Organizational Decision Support-System	1	User participation	0.457
	2	Organizational characteristics	0.43
	3	System characteristics	0.262
	4	Management support	0.253
	5	User training	0.17

Figure 6-1: Ranking of success factors on system types¹⁰⁴

Without going into too much detail, Figure 6-1 shows one analysis trying to rank different factors based on empirical studies. The link between the type of system and ranking of the specific success factors is highly significant. Therefore the success factors can be used as a general overview and start for users in practice to get into the basic improvement process of their BIS. When more precision and a weighted relevance are necessary more specific literature should be considered.

An analysis of the findings further indicates that non-technical factors, including organizational and process-related factors, are more influential and important than technological and data-related factors.¹⁰⁵

It could have been more valuable to derive success factors for only one type of IS but without further empirical studies the reliability and ranking would have been hard to obtain and sustain. Additionally, the context-free expression problem from chapter 3.2 might have been destroying that additional value in the end.

¹⁰⁴ Hartono, Santhanam et al. 2007, p.264.

¹⁰⁵ Cf. Yeoh, Koronios (2010), p. 31.

Additionally, the gathered success factors should be underpinned by further empirical studies.

There are several ways to expand this thesis. Based on the success factors something similar to balance scorecard for BI&AS could be researched on and verified in practice. This would have the potential to greatly enhance the control and insight on the BI&AS through its lifecycle and conclude in a greater success of the BI&AS.

7. Literaturverzeichnis

Agarwal, Croson, Mahoney (2009)

Rajshree Agarwal, Rachel Croson, Joseph T. Mahoney: The role of incentives and communication in strategic alliances: an experimental investigation. In: Strategic Management Journal. Nr. 1, Jg. 31, 2009, p. 413-437

Albescu, Pugna, Paraschiv (2008)

Felicia Albescu, Irina Pugna, Dorel Paraschiv: Business Intelligence & Knowledge Management – Technological Support for Strategic Management in the Knowledge Based Economy. In: Revista Informatica Economica. Nr. 4, Jg. 48, 2008, p. 5-12

Alexander (1985)

Larry D. Alexander: Successfully implementing strategic decisions. In: Long Range Planning. Nr. 3, Jg. 18, 1985, p. 91-97

Ariyachandra, Frolick (2008)

Thilini R. Ariyachandra, Mark N. Frolick: Critical Success Factors in Business Performance Management—Striving for Success. In: Information Systems Management. Nr. 2, Jg. 25, 2008, p. 113-120

Arnott, Pervan (2005)

David Arnott, Graham Pervan: A critical analysis of decision support systems research. In: Journal of Information Technology. Nr. 2, Jg. 20, 2005, p. 67-87

Arnott, Pervan (2008)

David Arnott, Graham Pervan: Eight key issues for the decision support systems discipline. In: Decision Support Systems. Nr. 3, Jg. 44, 2008, p. 657-672

Bajwa, Rai, Brennan (1998)

Deepinderp. Bajwa, Arun Rai, Ian Brennan: Key antecedents of Executive Information System success: a path analytic approach. In: Decision Support Systems. Nr. 1, Jg. 22, 1998, p. 31-43

Barki, Huff (1985)

Henri Barki, Sid L. Huff: Change, attitude to change, and decision support system success. In: Information & Management. Nr. 5, Jg. 9, 1985, p. 261-268

Berzins (2012)

Gundars Berzins: Strategic Management in Creative Industry Organizations: Specifics in Strategic Decision Making. In: Management of Organizations. Nr. 62, Jg. 1, 2012, p. 7-23

Bogdana, Albescu, Babeanu (2009)

Pugna I. Bogdana, Felicia Albescu, Delia Babeanu: The Role of Business Intelligence in Business Performance Management. In: Annals of Faculty of Economics. Nr. 1, Jg. 4, 2009, p. 1025-1029

- Chaudhuri, Dayal, Narasayya (2011)
Surajit Chaudhuri, Umeshwar Dayal, Vivek Narasayya: An overview of business intelligence technology. In: Communications of the ACM. Nr. 8, Jg. 54, 2011,p. 88
- Chen, Lee (2003)
Jim Q. Chen, Sang M. Lee: An exploratory cognitive DSS for strategic decision making. In: Decision Support Systems. Nr. 2, Jg. 36, 2003,p. 147-160
- Cheng (2012)
Eric Y. Cheng: Business Intelligence Systems for Strategic Management Processes: Framework and Hypotheses. In: Northeast Decision Sciences Institute Conference Proceedings. Nr. 4, Jg. 12, 2012,p. 255-263
- Courtney (2001)
James F. Courtney: Decision making and knowledge management in inquiring organizations: toward a new decision-making paradigm for DSS. In: Decision Support Systems. Nr. 1, Jg. 31, 2001,p. 17-38
- Dinter (2013)
Barbara Dinter: Success factors for information logistics strategy — An empirical investigation. In: Decision Support Systems. Nr. 3, Jg. 54, 2013,p. 1207-1218
- Elbanna, Child (2007)
Said Elbanna, John Child: Influences on strategic decision effectiveness: Development and test of an integrative model. In: Strategic Management Journal. Nr. 4, Jg. 28, 2007,p. 431-453
- Franklin (2013)
Carter L. Franklin: Developing Expertise in Management of Decision-Making. In: Academy of Strategic Management Journal. Nr. 1, Jg. 12, 2013,p. 21-37
- Fredrickson (1986)
James W. Fredrickson: The Strategic Decision Process and Organizational Structure. In: Academy of Management Review. Nr. 2, Jg. 11, 1986,p. 280-297
- Gelderman (2002)
Maarten Gelderman: Task difficulty, task variability and satisfaction with management support systems. In: Information & Management. Nr. 7, Jg. 39, 2002,p. 593-604
- Grover, Segars (2005)
Varun Grover, Albert H. Segars: An empirical evaluation of stages of strategic information systems planning: patterns of process design and effectiveness. In: Information & Management. Nr. 5, Jg. 42, 2005,p. 761-779
- Guimaraes, Yoon, Clevenson (1996)
Tor Guimaraes, Youngohc Yoon, Aaron Clevenson: Factors important to expert systems success a field test. In: Information & Management. Nr. 3, Jg. 30,

1996,p. 119-130

Hall, Davis (2007)

Dianne J. Hall, Robert A. Davis: Engaging multiple perspectives: A value-based decision-making model. In: Decision Support Systems. Nr. 4, Jg. 43, 2007,p. 1588-1604

Hall, Paradice (2005)

Dianne J. Hall, David Paradice: Philosophical foundations for a learning-oriented knowledge management system for decision support. In: Decision Support Systems. Nr. 3, Jg. 39, 2005,p. 445-461

Hartono, Santhanam, Holsapple (2007)

Edward Hartono, Radhika Santhanam, Clyde W. Holsapple: Factors that contribute to management support system success: An analysis of field studies. In: Decision Support Systems. Nr. 1, Jg. 43, 2007,p. 256-268

Hejazi, Yazdanpanah, Hadi-Vencheh (2011)

Somayeh Hejazi, Sahar Yazdanpanah, Abdollah Hadi-Vencheh: Critical success and failure factors analysis in Management Information System utilization using fuzzy approach. In: INTERDISCIPLINARY JOURNAL OF CONTEMPORARY RESEARCH IN BUSINESS. Nr. 2, Jg. 3, 2011,p. 717-730

Holden, Wilhelmij (1995-96)

Tony Holden, Paul Wilhelmij: Improved Decision Making through Better Integration of Human Resource and Business Process Factors in a Hospital Situation. In: Journal of Management Information Systems. Nr. 3, Jg. 12, 1995-96,p. 21-41

Isik, Jones, Sidorova (2011)

Oyku Isik, Mary C. Jones, Anna Sidorova: BUSINESS INTELLIGENCE (BI) SUCCESS AND THE ROLE OF BI CAPABILITIES. In: Intelligent Systems in Accounting, Finance and Management. Nr. 4, Jg. 18, 2011,p. 161-176

Kim, Yang, Kim (2008)

Choong N. Kim, Kyung H. Yang, Jaekyung Kim: Human decision-making behavior and modeling effects. In: Decision Support Systems. Nr. 3, Jg. 45, 2008,p. 517-527

Klingebiel, Meyer (2013)

R. Klingebiel, A. de Meyer: Becoming Aware of the Unknown: Decision Making During the Implementation of a Strategic Initiative. In: Organization Science. Nr. 1, Jg. 24, 2013,p. 133-153

Kumar (2011)

Ashvine Kumar: Strategic cost management – suggested framework for 21st Century. In: Journal of Business and Retail Management Research. Nr. 2, Jg. 5, 2011,p. 118-130

- Luftman, Ben-Zvi (2010)
Jerry Luftman, Tal Ben-Zvi: Key Issues for IT Executives 2010: Judicious IT Investments Continue Post-Recession. In: Management Information Systems Quarterly Executive. Nr. 4, Jg. 9, 2010,p. 264-273
- Martin (1982)
E. W. Martin: Critical Success Factors of Chief MIS/DP Executives. In: Management Information Systems Research Center, University of Minnesota. Nr. 2, Jg. 6, 1982,p. 1-9
- Nastase (2010)
Marian Nastase: Developing a Strategic Leadership Approach within the Organizations1. In: Review of International Comparative Management. Nr. 3, Jg. 11, 2010,p. 454-460
- Nooraie (2012)
Mahmood Nooraie: Factors Influencing Strategic Decision-Making Processes. In: International Journal of Academic Research in Business and Social Sciences. Nr. 7, Jg. 2, 2012,p. 662
- Nutt (2008)
Paul C. Nutt: Investigating the Success of Decision Making Processes. In: Journal of Management Studies. Nr. 2, Jg. 45, 2008,p. 425-455
- Olie, van Iterson, Simsek (2012)
René Olie, Ad van Iterson, Zeki Simsek: When Do CEOs Versus Top Management Teams Matter in Explaining Strategic Decision-Making Processes? In: International Studies of Management and Organization. Nr. 4, Jg. 42, 2012,p. 86-105
- Papadakis, Lioukas, Chambers (1998)
Vassilis M. Papadakis, Spyros Lioukas, David Chambers: Strategic Decision-Making Processes: The Role of Management and Context. In: Strategic Management Journal. Nr. 1, Jg. 19, 1998,p. 115-147
- Pedro M. Kono, Barry Barnes (2010)
Pedro M. Kono, Barry Barnes: The Role of Finance in the Strategic-Planning and Decision-Making Process. In: Graziadio School of Business and Management. Nr. 1, Jg. 13, 2010,p. 1-5
- Poon, Wagner (2001)
PoPo Poon, Christian Wagner: Critical success factors revisited: success and failure cases of information systems for senior executives. In: Decision Support Systems. Nr. 4, Jg. 30, 2001,p. 393-418
- Popescu (2012)
Sabrina Popescu: Business Intelligence Solutions - a Way of General Improvement of Efficiency and Effectiveness. In: Review of International Comparative Management. Nr. 1, Jg. 13, 2012,p. 88-95

Popovič et al. (2012)

Aleš Popovič, Ray Hackney, Pedrop. Coelho, Jurij Jaklič: Towards business intelligence systems success: Effects of maturity and culture on analytical decision making. In: Decision Support Systems. Nr. 1, Jg. 54, 2012,p. 729-739

Rainer, Watson (1995)

R.Kelly Rainer, Hugh J. Watson: What does it take for successful executive information systems? In: Decision Support Systems. Nr. 2, Jg. 14, 1995,p. 147-156

Shahin, Attarpour (2011)

Arash Shahin, Mohammad R. Attarpour: Developing Decision Making Grid for Maintenance Policy Making Based on Estimated Range of Overall Equipment Effectiveness. In: Modern Applied Science. Nr. 6, Jg. 5, 2011,p. 86-97

Singh, Watson, Watson (2002)

Sanjay K. Singh, Hugh J. Watson, Richard T. Watson: EIS support for the strategic management process. In: Decision Support Systems. Nr. 1, Jg. 33, 2002,p. 71-85

Skaržauskiene (2010)

Aelita Skaržauskiene: Managing complexity: systems thinking as a catalyst of the organization performance. In: Measuring Business Excellence. Nr. 4, Jg. 14, 2010,p. 49-64

Souitaris, Maestro (2010)

Vangelis Souitaris, B. M. M. Maestro: Polychronicity in top management teams: The impact on strategic decision processes and performance of new technology ventures. In: Strategic Management Journal. Nr. 1, Jg. 31, 2010,p. 652-678

Stanciu, Petrusel (2012)

Paula-Ligia Stanciu, Razvan Petrusel: Implementing Recommendation Algorithms for Decision Making Processes. In: Informatica Economica. Nr. 3, Jg. 16, 2012,p. 87-104

TDWI (2011)

TDWI: Success Factors for Business Intelligence and Data Warehousing Maturity and Competitive Advantage. In: Business Intelligence Journal, Number 1. Nr. 1, Jg. 16, 2011,p. 22-29

Teo, Ang (1999)

Thompsonp. Teo, Jamesp. Ang: Critical success factors in the alignment of IS plans with business plans. In: International Journal of Information Management. Nr. 2, Jg. 19, 1999,p. 173-185

Thomas (1984)

Howard Thomas: Strategic Decision Analysis: Applied Decision Analysis and its Role in the Strategic Management Process. In: Strategic Management Journal. Nr. 3, Jg. 5, 1984,p. 139-156

Trull (1966)

Samuel G. Trull: Some Factors Involved in Determining Total Decision Success. In: Management Science. Nr. 6, Jg. 12, 1966,p. 270-280

van Bruggen, Wierenga (2001)

Gerrit van Bruggen, Berend Wierenga: Matching management support systems and managerial problem-solving modes. In: European Management Journal. Nr. 3, Jg. 19, 2001,p. 228-238

Woodside (2011)

Joseph Woodside: Business Intelligence Best Practices for Success. In: Proceedings of the 2nd International Conference on Information Management. Nr. 1, Jg. 2, 2011,p. 556-562

Yeoh, Koronios (2010)

William Yeoh, Andy Koronios: Critical Success Factors for Business Intelligence Systems. In: Journal of Computer Information Systems. Nr. 3, Jg. 50, 2010,p. 23-32

Yeoh, Koronios, Gao (2008)

William Yeoh, Andy Koronios, Jing Gao: Managing the Implementation of business Intelligence Systems:. In: IGI PUBLISHING. Nr. 3, Jg. 4, 2008,p. 79-94

Zwikael, Globerson (2006)

Ofer Zwikael, Shlomo Globerson: From Critical Success Factors to Critical Success Processes. In: International Journal of Production Research. Nr. 17, Jg. 44, 2006,p. 3433-3449