EVALUATIVE STUDY ON THE MATURITY OF BENDER GROEP'S INFORMATION SYSTEMS UTILIZATION

Bachelor thesis

de Groot, G.J.L (Gerben)

University of Twente

Faculty of Behavioral, Management, and Social Sciences

Bachelor of Science in Industrial Engineering and Management

09/2022

BSc Industrial Engineering & Management

EVALUATIVE STUDY ON THE MATURITY OF BENDER GROEP'S INFORMATION SYSTEMS UTILIZATION

Author: G. de Groot (Gerben)

S2385805

Number of pages: 67

This report was written as part of the bachelor thesis project assignment in the Industrial Engineering & Management educational program

UNIVERSITY OF TWENTE.

University of Twente
Drienerlolaan 5
7522 NB Enschede

Supervisors
Dr. Ir. E.J.A. Folmer (Erwin)
Dr. Ir. A.A.M. Spil (Ton)

Bender Groep
Keulenstraat 10
7418 ET Deventer

Supervisor
M. Van Bussel (Mark)

PREFACE

Dear reader,

Before you lies my bachelor thesis “Evaluative study on the maturity of Bender Groep’s information systems utilization”, written to complete the bachelor of science in Industrial Engineering and Management. This thesis presents the research that was conducted at Bender Groep in the period from February until August (2022) and entails the evaluation of the maturity of information systems utilization within the company. This research aims to apprise management of the challenges regarding the realization of mature information systems usage.

First, I would like to especially thank Mark van Bussel for guiding and supervising me at Bender Groep throughout the research process, and Jeroen Kiepman for providing valuable information and ideas regarding the current information systems. The time and effort they put in to support me with their knowledge and guidance were indispensable and truly commendable. Alongside them, I would also like to thank everyone I worked with during my time at the company for their enthusiasm and willingness to help. They all helped me to enjoy my time at the office, which I experienced to be a pleasant working environment from which I gained a substantial amount of knowledge and experience.

Second, I want to thank both of my supervisors from the University of Twente for their unconditional guidance during this research. Erwin Folmer was my first supervisor and, therefore, guided me from the start of the project. He provided feedback in regular meetings to establish and enhance the topic and scope of my research. Ton Spil was my second supervisor and provided a substantial amount of additional feedback on the completion of the research.

Finally, I would like to thank my family and friends for supporting me during this project. They were always open to discussing any questions, which helped me to maintain the scope of this research consistently.

Kind regards,

Gerben de Groot

Enschede, September 2022

ABSTRACT

The continuous development of information systems within organizations has been proven to benefit organizations to optimize operations on the strategic, operational, and tactical levels. Nevertheless, investing in them bring along risks as a result of, for instance, inadequate technology or the recurrence of familiar, established processes. These risks accompanied by the usage of information systems have driven academic research which considers evaluation methods regarding the utilization of information systems.

In this research, the maturity of the information systems within Bender Groep – a secondment company– is evaluated by combining multiple methods from academic literature. My research findings show that Bender Groep can improve the maturity of its information systems through periodical meetings, documenting processes, and involving users in decision-making.

Furthermore, this research documents the processes surrounding the information systems and, by researching, combining, and utilizing two separate methods found in existing literature, makes it evident that Bender Groep can improve in some areas. The models used are the Strategic Alignment Maturity Model (SAMM) and the Technology Acceptance Model (TAM) which were proposed and responded to by employees of the organization to evaluate the maturity of their information systems utilization.

My research reflects that Bender Groep currently has an established alignment between IT and business and makes the organization aware of the challenges regarding the realization of mature information systems utilizations. The challenges are illustrated by the results from both models. These results indicate that the utilization can improve in the level of transparency it provides to the business and the level of innovation, change readiness, hiring, and retaining. Additionally, the acceptance of new information systems should not be neglected; It was concluded that employees of the organization have to be convinced that the system is used voluntarily because of its relevance, quality, and ease of use.

CONTENTS

READERS GUIDE

This paper consists of nine chapters containing sections and sub-sections. This section functions as a guide to understanding the structure and layout of the article. Consequently, this section summarizes each chapter. To go to a chapter, click the respective header below.

CHAPTER 1 - INTRODUCTION

This chapter introduces the research topic by identifying and explaining the problem context. The core problems, action problem, and research question follow from this. Next, the chapter describes important knowledge questions that present the research outline.

CHAPTER 2 – RESEARCH DESIGN

This chapter concerns the research methodology and divides the research design into eight phases which enables us to answer the knowledge questions as formulated in the first chapter. It structures the research before it is performed and discusses the problem-solving method, operationalization, and final deliverables.

CHAPTER 3 - LITERATURE REVIEW ON INFORMATION SYSTEMS

This chapter includes a literature review concerning basic concepts regarding information systems. These include concepts such as the definition, architecture, strategy, justification, and data modeling.

CHAPTER 4 – LITERATURE REVIEW ON EVALUATIVE METHODS OF INFORMATION SYSTEMS

This chapter contains a literature review on methods for evaluating information systems, providing the theoretical framework for this research to assess the maturity of the information systems within Bender Groep.

CHAPTER 5 – INFORMATION SYSTEMS WITHIN BENDER GROEP

This chapter explores the information systems used within the organization, applying the knowledge obtained from the literature reviews in the previous chapters. Note that this chapter is only descriptive of the information systems and does not include any evaluation of the utilization in the case of Bender Groep.

CHAPTER 6 - ANALYSIS OF THE UTILIZATION OF INFORMATION SYSTEMS

This chapter analyses the utilization and maturity of the information systems within Bender Groep by applying the evaluative methods proposed in the literature review. To this end, users from Bender Groep were questioned to explore all the functionalities and opportunities of the current information systems.

CHAPTER 7 - RECOMMENDATIONS

This chapter builds upon the research by recommending steps to be undertaken to increase the maturity of the information systems of Bender Groep. These recommendations originate from experiences and literature studied while performing the research presented in this paper.

CHAPTER 8 - DISCUSSION

This chapter discussed the validity, reliability, and limitations of this research. These concepts need discussion to evaluate whether the research is researching what is aimed.

CHAPTER 9 - CONCLUSION

This chapter concludes all findings from this research by assessing the problem-solving process. To this end, it mentions and answers the research question formulated in the research design.

LIST OF ACRONYMS

BI	Business Intelligence
BPMN	Business Process Modeling Notation
DW(s)	Data warehouse(s)
ELM(s)	Elaboration Likelihood Model(s)
ER	Entity-Relationship
ERP	Enterprise Resource Planning
ETL	Extract, Transform, Load
IS	Information System(s)
IT	Information Technology
MPSM	Managerial Problem-Solving Method
MVOTs	Multiple Versions of Truth
OLAP	Online Analytics Processing
OLTP	Online Transaction Processing
SAMM	Strategic Alignment Maturity Model
SVOT	Single Version of the Truth
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

The introduction first describes the context of this research. Additionally, it provides background information to understand the company. Furthermore, problem identification follows after acquiring a deeper understanding of the research topic.

1.1. CONTEXT DESCRIPTION

The company where this research is conducted, Bender Groep – located in Deventer, Utrecht, and Amsterdam – recruits, educates, and employs people to third parties (secondment) within the social domain, spatial domain, and healthcare. Bender Groep implemented AFAS software and Power BI in 2015 and late 2021, respectively. These information systems are used to analyze the performance of Bender Groep by key performance indicators. Although these indicators should be selected carefully, this is not the scope of this research. Alternatively, the research is concerned with evaluating whether the information systems can be used effectively to eventually come to the reports or dashboards containing valuable insights into the performance of the business.

Furthermore, the organization has grown from approximately 200 employees in 2015 to over 1000 employees at the time of writing this paper. As a result of this, the workload within the business control unit (primarily responsible for providing insights into the performance) intensified. For this reason, the team was reinforced last year. Despite this, the management of Bender Groep is concerned that the trend of growth that is expected to continue will illustrate that the information systems prove to be inadequate to accommodate that growth. Altogether, this could result in insufficient insight into the performance of the company and difficulties in retrieving information for decision-makers.

Bender Groep consists of internal- and external employees. The external employees are referred to as “professionals”, who can be on secondment, in education, or not in action. These statuses are relevant to the decision-makers as they search for trends among these employees to optimize their effectiveness (preferably, every professional is on secondment as soon as possible and at all times). These professionals are managed by regional managers, who are in turn managed by the management. For more information on the organizational structure of Bender Groep, refer to Figure A-1: Organizational chart of Bender Groep.

To summarize, this research concerns an evaluation of the maturity of the information systems within Bender Groep as a result of an increasing need for reports because the company is growing substantially. The effectiveness of the business control unit needs to be optimized as, although it has been reinforced lately, more growth could lead to inadequate reporting to the management.

1.2. PROBLEM IDENTIFICATION

1.2.1. PROBLEM DEFINITION

As mentioned within the context description, Bender Groep is using AFAS software since 2015, whereas Power BI was implemented in 2021. From meetings with the financial director, it can be concluded that

the understanding of the systems could improve: The utilization of these information systems is reliant on a few individuals (if these were to leave, a substantial amount of business process knowledge is lost). Consequently, the management is unsure whether the utilization of their information systems is adequate and aligned with their business. As a result of this, an evaluative study is performed to investigate the maturity of their information systems.

Furthermore, despite Bender Groep's growth, (part of) the utilization of their information systems remains unchanged. As a result, the importance of evaluating the maturity of the information systems utilization is evident. Hence, the maturity of the information systems within Bender Groep is assessed to utilize its assets effectively.

1.2.2. ACTION PROBLEM

According to (Heerkens & van Winden, 2016), an action problem is “any situation that is not how you want it to be.” In other words, “a discrepancy between the norm and reality as perceived by the owner.” The uncertainty surrounding the maturity of their information systems challenges Bender Groep to preserve/improve in this respect. To this end, we define this as the action problem:

“THE MATURITY OF THE UTILIZATION OF BENDER GROEP’S INFORMATION SYSTEMS SHOULD BE EVALUATED AS THIS IS CURRENTLY UNCERTAIN.”

The action problem adheres to the definition of an action problem as it recognizes a norm and a reality. In reality, the maturity of the utilization of Bender Groep’s information systems is not understood well, which should be the case.

1.2.3. PROBLEM CLUSTER

To gain more insight into the action problem formulated above, a meeting with one of the directors of Bender Groep was held. These meetings were held to identify and confirm the problems occurring and are visualized in Figure 1-1: Problem cluster. This problem cluster only contains relevant issues that are identified as such. They are only included when unmistakably existent and influenceable (Heerkens & van Winden, 2016).

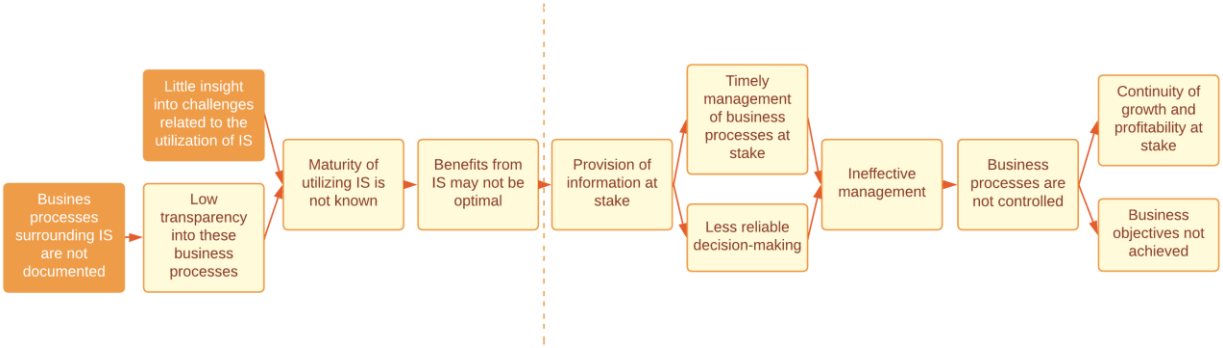


Figure 1-1: Problem cluster

In the rest of this sub-section, an elaboration on the problem cluster is provided. Consequently, the problem cluster is split into two halves, separated by the dotted line. These halves will be elaborated on in turn to structure this section. To this end, the affected problem will be the starting point of both explanations to explain the reasoning of all cause-and-effect relationships. To this end, we start from the right side of the problem cluster.

1. The profitability, growth, and compliance with business objectives are logically at stake when management does not control business processes effectively. The effectiveness of business control could be caused by untimely management actions or unreliable decision-making. All these are effects of an inadequate provision of data to the management. The causes of insufficient provision of information are mentioned below.
2. The affected problem in the left half mentions that the benefits from Bender Groep's information system may not be optimal whenever the causing problems occur before this. The reason why the benefits are not optimal is naturally because the information systems are not used optimally, which in turn could have multiple causes. It could be that there is not much insight into the challenges that information systems face, or there is not much transparency into the business processes surrounding them. The latter may be caused by the fact that there is no documentation of the processes surrounding the systems. In both causes, less control and standardization of the processes cause inefficient utilization of the information systems.

1.2.4. CORE PROBLEM

The problem cluster is useful to establish a core problem as the core problem is the root cause of the chain of problems. After formulating a problem cluster, we can subsequently determine the core problem of this research as well (refer to Figure 1-1: Problem cluster).

According to Heerkens & van Winden (2016), the core problem is found by following the chain of problems to these problems, which have no direct cause. Core problems are, therefore, always at the beginning of the chain problems (see problem cluster; The core problems are marked). Consequently, this research is based on the following two core problems:

"BENDER GROEP HAS LITTLE INSIGHT INTO CHALLENGES RELATED TO THE UTILIZATION OF THEIR INFORMATION SYSTEMS"

AND

"BUSINES PROCESSES SURROUNDING THE INFORMATION SYSTEMS OF BENDER GROEP ARE NOT DOCUMENTED"

As explained in the previous sub-section, the core problems are the root cause of a chain of problems. Following Heerkens & van Winden's (2016) research, these problems should be examined for practical problem-solving.

1.3. RESEARCH/KNOWLEDGE QUESTIONS

Knowledge questions defined in this section will need to be answered to gain knowledge and support the process of answering the main research question. We describe the main research question as the question that needs to be answered to provide an answer to the problems mentioned previously. This research question is:

"HOW IS THE CURRENT MATURITY OF THE INFORMATION SYSTEMS WITHIN BENDER GROEP, AND WHAT IS IT CHALLENGED BY?"

To be able to answer this research question, the following knowledge questions are initially formulated:

1. Which information systems are classified in businesses? And how are these defined?

   Before analyzing the current information systems within Bender Groep, existing information system types are researched. To this end, an explorative study is performed to understand key concepts related to information technology. Note that this study is exploratory and provides in-depth definitions of multiple concepts. These can be found in chapter 3: Literature review on information systems

2. What challenges are businesses faced with regarding the alignment between their information systems and business strategy?

   The literature will be reviewed to research the challenges of aligning business strategy and its information systems. Finding these challenges is the primary goal of the literature review, which can be found in chapter 4: Literature review on evaluative methods of information systems.

3. Which existing methods of evaluating information systems are proposed in the literature?

   Besides answering the knowledge question mentioned before, existing methods for evaluating information systems and their alignment with business objectives are proposed in chapter 4: Literature review on evaluative methods of information systems. Note that this knowledge question is answered using the same literature searches as the previous question and therefore requires no separate literature review.

4. Which information systems are used within Bender Groep itself?

   In contrast to the first and second knowledge questions, the specific situation within Bender Groep is considered here. As mentioned previously, this research is limited to AFAS and Power BI. These information systems are analyzed by a meeting with the controller of Bender Groep and empirical findings. This knowledge question is examined in chapters 5 and 6.

5. Who are the users of the information systems within Bender Groep?

The users of the information systems are identified better to understand the uses of the systems within the organization. This question was asked to the controller and is addressed in chapter 6: Evaluation of the utilization of information systems.

6. Are there already weaknesses in mind regarding utilizing the current information systems?

As previously mentioned, the current use of information systems needs to be analyzed. It is, therefore, of importance that the current weaknesses are assessed. To this end, a meeting was held with the financial director and, after his advice, with the controller. These meetings led to ideas concerning the documentation of the AFAS software. For more information on these, refer to chapter 6: Evaluation of the utilization of information systems.

7. How can Bender Groep improve the maturity of its information systems utilization given the evaluation provided in this paper?

This paper proposes ways for improving the maturity of information systems utilization in chapter 7: Recommendations. These recommendations are based on the evaluation and, therefore, tackle the improvement points identified in it.

2. RESEARCH DESIGN

2.1. PROBLEM-SOLVING APPROACH

The problem-solving approach is structured in seven phases. These phases are presented within this section and provide a framework in which all knowledge questions are examined. The framework links all phases with the knowledge questions (see section 1.3) answered within it. It is therefore advised to refer to that section as well.

I. Systematic literature review on key concepts related to information systems/technology

A systematic literature review will be performed to answer (some of) the knowledge questions formulated in the first phase. The goal of this phase is to acquire a deeper understanding of concepts related to the research. This literature review regards essential explanations of key concepts to get acquainted with the topic before reviewing the current situation.

The literature review is highly structured, enhancing this research's reliability and validity. The systemic search strategy used for this review is from a course at the University of Twente in preparation for this research given by R. Cruz (2022). Knowledge question 1 is answered in this phase.

II. Designing/planning of research design

Phases I and II concern the preparation of the actual research. The research design is planned within phase II. This design is about the actions that will need to be taken to eventually develop recommendations that should improve the maturity of Bender Groep's information systems utilization.

III. Systematic literature review on IT-business alignment

After defining multiple key concepts, another systematic literature review is performed on IT-business alignment. This research discusses the challenges on this topic and eventually elaborates on these by proposing an evaluative method for IT-business alignment. Knowledge questions 2 and 3 are answered within this phase.

The research method used for this systematic literature review is similar to the first: From R. Cruz (2022).

IV. Research of the current information systems used by Bender Groep

This phase aims to identify the problem and its relationship with the current situation and includes meetings with users and administrators and observations of the systems. It builds upon the literature review performed in the first phase. Knowledge questions 4 and 5 are answered within this phase.

V. Research possible improvements to the current utilization of information systems by meeting with the controller and the financial director

In this step, the purpose is to come up with ideas to improve the data organization. At this point, it should be possible to come up with ideas to optimize Bender's position for the time to come. Besides concluding the literature review performed earlier with recommendations, new insights could become apparent, leading to new ideas for improvement.

VI. Evaluate the maturity of Bender Groep's information system utilization using the evaluative methods proposed in phase III.

After the first five phases, an understanding of the information systems used by Bender Groep is established, and ideas from stakeholders are analyzed. However, an evaluation of the information systems is not systematically performed regarding their actual performance. This phase, therefore, evaluates these systems using the models provided in the literature review. This evaluation should result in recommendations on different areas regarding the maturity of the information systems. The model is used with four employees of Bender Groep: The director, controller, functional manager of AFAS, and HR manager. This is because the model needs to be evenly evaluated from the IT- and Business perspectives. The results are concluded within chapters 6 and 7.

VII. Compose report and plan colloquium

The last phase will be about concluding the findings within a report which includes all deliverables and elaborates on how this research is performed. Within this phase, the colloquium will be planned and finished as well.

2.2. TYPE OF RESEARCH

The overall type of research can be described as exploratory research. As the name suggests, this type of research explores a problem that is not clearly defined yet. Therefore, this research contains the identification of current processes to define problems, after which literature studies will be used to define

the core concepts related to the identified problems. This implies that qualitative methods will need to be used, such as interviewing, empirical research, and the previously mentioned literature studies.

This research will consist of a mix of desk- and field research. This category of research activities represents the literature studies and all other activities in which information is reviewed. Field/primary research is defined as the qualitative research activities performed to gain knowledge of a particular setting by observing in the attempt to understand this setting. The activities in this research identified as these activities are interviews/meetings and miscellaneous empirical research to monitor the current data organization (e.g., interviews with users and observing the system itself). The interviews/meetings will also concern a brainstorming session to develop ideas for improvement, performed with the users and administrators of the data organization.

2.3. INTENDED DELIVERABLES

As aforementioned, this research is evaluating the maturity of the information system of Bender Groep. Within this section, the deliverables that resulted from this research are summarized in short.

The primary constructs and the respective deliverables related to this research are found in Table 2-1: Specification of deliverables.

First, the information systems will be evaluated in terms of their functionalities and architecture, resulting in the documentation of the processes surrounding the use of the information systems. This documentation includes an analysis of all steps required to utilize the systems. To this end, a BPMN and an ER diagram are formulated to make these processes more transparent.

Secondly, a methodological method to evaluate the maturity of the information systems is proposed from the literature and will be applied to provide recommendations for the company. These recommendations will finally be formulated as a result.

Naturally, these deliverables are included within this paper to conclude the research.

Construct	Deliverable
Assessment of current information systems	Identification and evaluation of IS used and their functionalities
	Analysis of the systems' processes (including BPMN)
	ER-diagram depicting entities and relationships
Evaluation of the maturity of the information systems	Methodological method for evaluating the maturity proposed and applied
	Recommendations
Thesis	Paper containing all findings

Table 2-1: Specification of deliverables

2.4. OPERATIONALIZATION

The core problems imply that this research should clarify the requirements and challenges regarding Bender Groep's information systems. This clarification is part of this research, resulting in recommendations to maintain/improve the current maturity of these systems. These recommendations are included at the end of this research. They need to be operationalized for them to be measurable, to eventually be able to evaluate and conclude whether the suggestions are effective.

One of the methods used to evaluate whether this is achieved is meeting with the management. These will be conducted regularly to gather stakeholders' evaluations of the research. The stakeholders that will be asked for their assessment are internal employees within Bender Groep that can be considered as the problem holders (the controller and the director).

The other method that will be used to operationalize this research is theoretical evidence, meaning that recommendations are justified because they originate from an already proven evaluation method. To this end, structured models for evaluation found in the literature are used within this research.

3. LITERATURE REVIEW ON INFORMATION SYSTEMS

This chapter presents the results of the literature review on information systems that was performed to provide background information on information systems. This background information explains the concepts related to information systems. The explorative nature of this chapter means that it is not focused on one concept but on multiple. It also aims to give prominence to the importance of the topic by defining its relationship with decision-making processes supported through information systems.

3.1. METHODOLOGY OF THE LITERATURE REVIEW

As previously mentioned, the research method used for this literature is from R. Cruz (2022). The conceptual matrix is provided below and functions as the framework on which this chapter builds. Note that the remaining documentation of the execution of the literature review is found in Appendix D: Literature review on information systems protocol

This chapter distinguishes concepts related to information systems, which are the following: Definitions regarding data organizations, the architecture of data organizations, the strategies that relate to the organization of data, the justification of data organization, and the documentation of information systems. These concepts form the sections that make up this chapter. These, as well as the papers used in each respective section, can be found in Table 3-1: Conceptual matrix of the literature review regarding information systems

The table provides insights into the topics that are discussed in this chapter. It should be noted that the purpose of presenting these concepts is to get acquainted with utilizing information systems within businesses.

PAPER	3.2. DEFINITION	3.3. ARCHITECTURE	3.4. STRATEGY	3.5. DATA MODELLING	3.6. JUSTIFICATION
1. (Bentley, 2017)	X				
2. (Sharda et al., 2017)	X	X			
3. (Saint-Louis et al., 2017)	X				
4. (Vo et al., 2018)	X				
5. (Eckerson, 2003)	X				X
6. (Jiang et al., 2008)		X			
7. (Dallemule & Davenport, 2017)			X		
8. (Ballard et al., 1998)				X	

Table 3-1: Conceptual matrix of the literature review regarding information systems

From the conceptual matrix above, it can be concluded that papers 1-5 contribute to the definitions of data organizations. Papers 2 and 4 contribute to the research into the architecture of data organizations, while paper 7 concerns data strategy, and paper 5 contributes to the justification of data organizations. Lastly, paper 8 describes how data organizations can be assessed. The concepts included in the conceptual matrix make up the sections in this chapter.

3.2. DEFINING SORTS OF INFORMATION SYSTEMS

This section contains definitions of relevant concepts that should be distinguished and understood to be able to analyze/classify the information systems that are currently in use by Bender Groep. This section starts with the definitions of Business Intelligence and Enterprise Resource Planning because both information systems within the scope of this research can be classified as one of these.

3.2.1. BUSINESS INTELLIGENCE (BI)

The earliest uses of the term BI dates to 1865, which was used to describe how profit was gained by receiving and acting upon information about the environment (Bentley, 2017). It has evolved as a content-free expression as it began to mean different things to different people (Bentley, 2017; Sharda et al., 2017), which caused a misunderstanding of the term (Saint-Louis et al., 2017) within the academic literature. For clarity, we therefore choose and consider one applicable definition.

Vo et al. (2018) define BI as “The process of extracting and predicting business-critical insights from raw data.” BI aims to enable interactive access to data to eventually generate actionable insights to make better, more informed decisions. The possibility of a data-driven decision-making process is therefore only possible with careful attention to the management of BI. Naturally, this has to do with managers needing the correct information at the right time and place. The availability of information is, therefore, one of the main challenges for BI. Accessible information improves the transparency of processes within an organization, helping organizations to run their business timely and intelligently (Eckerson, 2003).

In business intelligence, three types of analytics are distinguished (Eckerson, 2003): Descriptive analysis (i.e., what happened/is happening), predictive analysis (i.e., what will happen, and why?), and prescriptive analysis (i.e., what should be done, and why?). Descriptive analytics aims to gain insights into the company's operations while defining business problems. Visualization tools enable the possibility to provide these insights. Predictive analytics concern the development of projections to predict future events by analyzing current and historical events. To this end, various statistical techniques are used to mine data from the DW. Prescriptive analytics is a process that aids decision-making by providing a recommendation based on data. The analysis that is performed is dependent on the objectives of an organization. The analysis results are usually accessible through the BI portal: The primary access interface for the data.

3.2.2. ENTERPRISE RESOURCE PLANNING (ERP)

ERP overlaps with BI, but the main difference is that data captured in the ERP system (OLTP) is constantly updated and needs to be able to respond quickly. Because of this, queries[1] are usually standardized. It is concerned with shaping the business to structure and process transactions, whereas OLAP (BI data) is designed to adapt to the company. The ERP system captures and structures information for real-time insight into several processes. The data it captures is structured within a DW and needs to be analyzed and processed using statistical techniques and querying. The OLAP system facilitates this process: BI software organizes input to provide the users with answers by analyzing multidimensional databases through complex queries.

Specific standardized processes enable the real-time capabilities of the OLTP, while historical data in BI requires complex, freeform queries to gain insights. The fundamental design differences are summarized in Figure B-1: Basic design differences between transaction- and BI systems (Eckerson, 2003).

3.3. ARCHITECTURE OF INFORMATION SYSTEMS

The information systems mentioned in the previous section are naturally data-driven, requiring raw data to extract valuable insights to help achieve business objectives. As a consequence, a more in-depth description of the architecture of these systems is provided in this section. This description starts with the findings of a review of the systems from a data level, meaning that the architecture of the data organization (i.e., the architecture surrounding the raw data) is explained. After this description, we zoom

[1] Request for information or data from a data warehouse, so it can be retrieved and manipulated.

out to review the architecture on a software level (i.e., the software needed to transform the raw data into valuable insights).

3.3.1. ON A DATA LEVEL

The architecture that organizes data should be designed according to the objectives of an organization. However, it always consists of the set of functions defined in Figure 3-1: The architecture of data organization (Jiang et al., 2008). The figure consists of an upper- and underlying layer. The upper layer provides various data management tools and data services. The functionalities of data services include the possibility to query, cache, store, and transfer data, as well as provide metadata[2]. Data management functions consist of the registration of data, as well as the management of metadata. The underlying layer provides an access interface to various data sources (Jiang et al., 2008). The distinction should be made between structured- and unstructured data because structured data is analytics-ready, contrary to semi-structured/unstructured data.

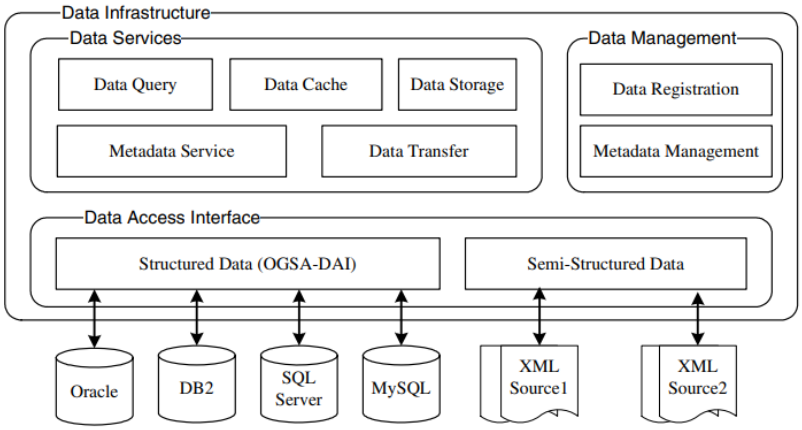


Figure 3-1: The architecture of data organization (Jiang et al., 2008)

3.3.2. ON A SOFTWARE LEVEL

Figure 3-2: The data organization structure (Sharda et al., 2017) shows the relationships between all components. It summarizes the architecture of data organization as already discussed above. Note that OLTP systems are considered data sources (because they provide data for the DW) and that OLAP systems are applications to which the data is distributed after the DW. The figure visualizes the roles of the OLTP- and OLAP systems.

[2] Data that provides information about other data (Furner, 2020)

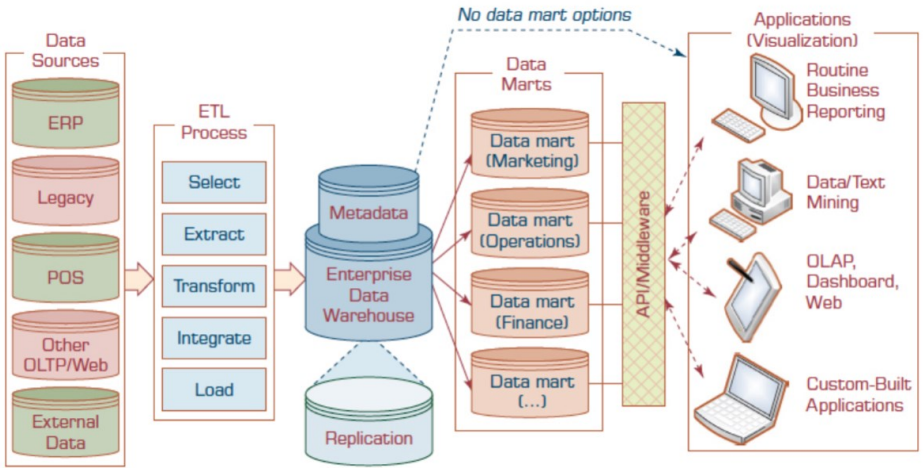


Figure 3-2: The data organization structure (Sharda et al., 2017)

When looking at the design enabling data to be transformed into information, it can be concluded that it consists of:

- An OLTP-system;
- A Data Warehouse (DW);
- An OLAP system; and
- A User interface (or: BI portal).

A DW is a repository of data from distinct sources. It integrates all data captured in the warehouse's history (through OLTP systems). This data can be used for any kind of analysis that is desired to be conducted (through OLAP systems). As the DW contains data for the entire organization, data marts are often created per business unit. Data marts are data repositories, just like the DW, but they collect a smaller set of data from the DW to provide easier access to the needed data.

The warehousing of data can be organized in different architectures. For the sake of simplicity, we consider the two most common architectures:

- The hub-and-spoke architecture consists of a central database, from which several dependent data marts are created to maintain the advantages of having one “single version of the truth.”
- The centralized data warehouse architecture consists of one central database, as seen in the hub-and-spoke architecture. However, this architecture does not contain data marts in any way: only one data warehouse has all the information.

The data marts can be of three different types, depending on the source that provides the data for the data. They can be:

- Dependent data marts: Top-down approach that retrieves defined data from a central DW.
- Independent data marts: Standalone repository containing different data than the DW.
- Hybrid data marts: Combination of both of the above.

3.4. DATA STRATEGY

After providing insights into the definitions and architecture related to information systems, we now review the strategy behind data utilization. The strategies presented show that not all companies can copy and adopt the same information systems; The use of information systems is not only decided by the internal organization but by many external factors such as regulations and competitive environments.

Data organizations can be designed according to two primary purposes of data: Defensive or offensive. The first is a centralized, control-oriented take on business information organizations and usually focuses on one single version of the truth (SVOT): one primary source with all data. The main goal of this strategy is to ensure control, reliability, security, and quality of data. Next to this, it enables easier regulatory compliance and governance. More flexible, offensive-oriented companies (mainly in highly competitive environments) may implement multiple versions of the truth (MVOTs), derived from the SVOT. This is because these MVOTs focus on supporting business objectives such as increasing revenue. To determine the right positioning on the offense-defense spectrum, companies should assess their overall strategy, regulatory- and competitive environment, maturity of data management, and the size of their data budget (Dallemule & Davenport, 2017).

Figure B-2: The data-strategy spectrum (Dallemule & Davenport, 2017) visualizes the offense-defense spectrum (Dallemule & Davenport, 2017). As shown, highly regulated environments (e.g., hospitals) usually adopt defensive data strategies, while less regulated, highly competitive environments (e.g., retailers) often adopt a more offensive strategy. The purposes of SVOTs and MVOTs support a defensive and offensive strategy, respectively. Companies should never default to one strategy but are always positioned somewhere in between the spectrum. Defensive data capabilities concern standardization and control, while offensive data strategies are concerned with data analytics (i.e., visualization, modeling, algorithms, etc.). With increasing technological advancements (e.g., in big data), possibilities for analyzing and optimizing processes are becoming more popular. This shifts the strategy towards more offensive data strategies (even in regulated environments).

3.5. DATA MODELING

A data model is an essential tool for developers that develop insights into a business's performance. This model represents the architecture of how data is stored and ordered into a data warehouse. When retrieving and combining data into reports or dashboards, this is important for the developers. To this end, we review these models shortly within this section.

Data modeling is “the process of creating a visual representation of either a whole information system or parts of it to communicate connections between data points and structures[3].” This visual representation of an information system is helpful to understand relationships among data within that information system and will therefore be clarified within this sub-section.

[3] IBM, What is data modeling? https://www.ibm.com/cloud/learn/data-modeling

The advantages of data modeling include the reduction of errors in database development, improvement in consistency of documentation across the organization, the improvement of the performance of an application, the improvement of communication between users, the facilitating of designing databases, etc.

Data models can be made in various types of diagrams/tables. Examples are the hierarchical model, the relational data model, and the entity-relationship diagram (ERD). These models can be made according to a certain level of abstractness. Models are therefore classified according to their abstractness. From the most abstract type of modeling to the least, the three types of data modeling are:

- Conceptual data models only include entity classes and their relationships. They offer a big-picture view of what the system contains.
- Logical data models contain data attributes such as data types.
- Physical data models represent the complete, finalized design of a database.

The data warehousing for Bender Groep is made possible by the currently used AFAS software. As the relationships and data types are automatically determined within the software, it is not relevant to understand all relationships related to the data. The primary motivation for using a data model is to simply gain more insight into the location of data that needs to be retrieved. In other words, a big picture view is desirable and already achieved with the data model's most abstract type of data model. This paper, therefore, includes the conceptual data model of the AFAS software. For more information on the conceptual data model, see section 5.1.2: AFAS Architecture.

So, any data model can be described according to its level of abstractness, but the data model's structure can also distinguish it. The structure of the data model is determined by whether the tables are normalized. The two possible models are:

- The star model: Not normalized, shorter queries. It has a very basic structure (Ballard et al., 1998); and
- The snowflake model: Normalized, requires longer queries to retrieve information. It exists from decomposing the star scheme (Ballard et al., 1998).

Note that models can easily be classified as a star- or snowflake model, as the models look like their namesakes (i.e., the star model is shaped like a star while the snowflake model looks like a snowflake. See Figure B-3: Star model example from Ballard et al. (1998), and Figure B-4: Snowflake model example from Ballard et al. (1998). The snowflake model is usually the more logical choice for experienced data modelers as they contain more detail. Also, the fact that they are normalized means that the database takes up less data storage as there are far fewer redundant records. When looking at the design of both models, it can be verified that queries are more complex for snowflake schemes. This paper will use the snowflake model because it is less flexible regarding analytical needs.

3.6. JUSTIFICATION OF BI

This section will cover the importance of investing in BI systems, as managing business intelligence solutions is costly and time-consuming, like many other technology projects. This is why many executives are reluctant to implement such projects. The reason for justifying business intelligence specifically is that these systems are widely underestimated and neglected by businesses, although the advantages of transactional systems are understood more quickly (because recording data is intuitively already done by most). Because of this, the benefits of using business intelligence are discussed in this section.

A survey from Eckerson (2003) shows the main benefits, resulting from executives who rated the benefits out of their BI investment as “high” or “very high.” From Figure B-5: Survey results on benefits of BI solutions. Based on 510 respondents who rated the value of benefits as “high” or “very high” (Eckerson, 2003, p. 11), it can be concluded that the time saved after implementing an adequate BI solution is rated to be the top benefit. This is especially true for larger organizations, as larger amounts of data require more effort in maintaining the quality and accuracy of data. It is therefore no surprise that the presence of a single version of the truth is the second-best rated benefit. This contributes to data accuracy across the company because multiple (redundant) versions of the truth, possibly containing different interpretations of data, are prevented. Other benefits are related to strategy, decision-making, process optimization, increase in revenue, etc.

Business intelligence solutions need optimization after implementation, a continuous and iterative process that should be performed incrementally. This is because organizations are unique and have different requirements, meaning that the first solution is seldom optimal. Therefore, it is only if the BI system is understood as an asset and effort is put into developing this system that the organization will benefit by changing the decision-making process into a fact-driven activity.

3.7. CONCLUSION

In conclusion, this chapter provided insights into the definitions of concepts regarding information systems. To this end, we firstly examined two relevant types of information systems, after which we reviewed these in detail. This enables us to recognize and understand information systems, which will be done later in this paper. Next to this, data models and their attributes are reviewed as well. A data model will be constructed later in this research to document the use of the AFAS software. Besides these direct applications, more concepts were reviewed within this chapter that provide more background information regarding the strategy and justification of data utilization. These concepts are mentioned to stretch the importance of the investments that need to be made in aligning business strategy and information systems.

This literature review aimed to explore basic concepts concerning information systems, therefore not proposing any methods for evaluating the alignment of business strategy and information systems. To this end, we must perform another literature search on evaluative methods to be able to assess the maturity of the information systems within Bender Groep.

4. LITERATURE REVIEW ON EVALUATIVE METHODS OF INFORMATION SYSTEMS UTILIZATION

In this chapter, results from the second literature review are presented. This literature review is performed to evaluate the information systems of Bender Groep. To this end, we start by investigating methodological models to evaluate the IT-Business alignment of an organization. The proposed model in this literature provides outstanding reliability and validity. After this, another model is proposed to evaluate the acceptance of the technology within the organization because information systems can provide little business value if not utilized/accepted. Note that the remaining documentation of the execution of the literature review is found in Appendix E: Literature review on evaluative methods oF information systems.

4.1. METHODOLOGY OF THE LITERATURE REVIEW

As mentioned previously, this literature review contains two main sections: These are on IT-business alignment and Technology Acceptance, respectively. It should be noted that the first is reviewed using the structured method from R. Cruz (2022). In contrast, the latter is reviewed by snowballing (the tracking of references (or citations) in documents), using another literature review on technology acceptance models as a starting point. Because of this, there is no documentation of the search terms, searches done, etcetera.

PAPER	4.2 IT-BUSINESS ALIGNMENT	4.3. TECHNOLOGY ACCEPTANCE MODEL
1. (Eckerson, 2003)	X	X
2. (Alsolamy et al., 2014)	X	
3. (Njanka et al., 2020)	X	
4. (Zhou & Cai, 2011)	X	
5. (J. Luftman & Brier, 1999)	X	
6. (J. N. Luftman, 2011)		X
7. (Agarwal & Prasad, 1997)		X
8. (Fishbein & Ajzen, 1975)		X
9. (L. Li, 2010)		X
10. (Octav-Ionut & Macovei, 2015)		X
11. (Davis, 1986)		X
12. (Davis & Venkatesh, 1996)		X
13. (Moore & Benbasat, 1991)		X
14. (Venkatesh & Davis, 2000)		X

Table 4-1: Conceptual matrix of the literature review on evaluative methods of information systems

4.2. IT-BUSINESS ALIGNMENT

According to Eckerson (2003), a strong alignment between business and IT is one of the main characteristics of success. In strong alignment of business strategy and IT, "two groups function as a single team with minimal organizational delineation between them." Correspondingly, it is mentioned that strong IT-business alignments are often guided by an executive steering committee that funds and prioritizes these, and a working committee that guides on an operational level. Nevertheless, before improving the IT-business alignment of an organization, the current alignment must be evaluated. To this end, evaluative methods of IT-Business alignment are reviewed within this section.

Before researching evaluation methods, IT-business alignment needs to be defined to understand the concept in more detail. Correspondingly, Njanka et al. (2020) consider the absence of a uniform definition of IT-business alignment to lower the success in aligning IT and business strategy. Although the concept was conceptualized in numerous ways in literature, we consider the definition from Zhou & Cai (2011): "Strategic alignment of IT exists when an organization's goals and activities and the information systems that support them remain in harmony." This means that the organization appropriately uses IT timely in any given situation.

Moreover, the difference between IT and business strategy should be clear to align these. From a business strategy point of view, technology should increase the organization's competitive advantage, while IT strategy considers technical aspects concerning the technology. Because of this difference, the responsible managers of these strategies need communication to align their interests, which should ultimately result in a mature strategy regarding their information systems.

Additionally, challenges in adopting IT-business alignment should be recognized to increase awareness of these challenges. As a result of this, the likelihood of failing to align the business strategy with IT is decreased. Njanka et al. (2020) and Zhou & Cai (2011) identify the following five challenges to the harmony between IT and business strategy:

- IT does not benefit the organization: Some companies invested millions in IT, only to find ineffective operations. This intuitively means that the IT and business strategy are not aligned;
- IT-business alignment cannot be sustained in the long run: Whenever IT-business alignment has been optimized, it remains pertinent to keep evaluating the organization's IT strategy because technology changes rapidly;
- Lack of communication: A lack of communication between business and IT leaders implies a low understanding of the business/IT strategy. Moreover, "it is an absolute requirement that developers possess business knowledge (Eckerson, 2003)." This causes an imbalance in harmony between IT and business strategy;
- Poor governance: Proper governance is essential to the success of aligning IT-business strategy, because budgets, systems, and processes need to be controlled by managers. Conversely, IT managers are often left out of these decision-making processes; and
- Lack of competence: A lack of competence is, in the rapidly changing environment of IT, surprisingly common. The continuously changing IT world means that the competency to strategize on IT solutions is difficult to uphold.

4.2.1. STRATEGIC ALIGNMENT MATURITY MODEL (SAMM)

This sub-section proposes the Strategic Alignment Maturity Model (SAMM) (J. N. Luftman, 2011). The model provides a tool for evaluating the maturity of the strategic alignment between IT and business. To this end, it is captured according to six areas of maturity:

- Communication maturity: The extent to which ideas are exchanged effectively; The level of understanding of business awareness by IT and vice versa (J. N. Luftman, 2011);
- Competency/Value measurement maturity: "Too many IT organizations cannot demonstrate their value to the business in terms that the business understands" (J. N. Luftman, 2011). As a result of this, a dashboard demonstrating the value of IT is useful. Consequently, this area is concerned with the value IT is contributing to the business;
- Governance maturity: The extent to which "the appropriate participants of business and IT are reviewing the priorities and allocation of IT resources" (Zhou & Cai, 2011);
- Partnership maturity: Business perception of the value of IT. Consequently, it concerns the willingness of participants to share the risks/rewards of the technology (Zhou & Cai, 2011);
- Scope maturity: "The level of flexibility and transparency the IT is providing to business" (Zhou & Cai, 2011); and
- Skills maturity: "The level of innovation, change readiness, hiring and retaining, and how they are contributing to the overall organizational effectiveness" (Zhou & Cai, 2011).

Note that these areas are similar to the challenges in adopting IT-business alignment. Consequently, these areas are formulated to evaluate the maturity of the information systems by taking these pitfalls into account.

The areas are evaluated based on levels and their respective attributes. As a result, the evaluation is more reliable and valid than evaluating information systems without this structured model.

It can be concluded that the attributes related to the levels generally conform to the following distribution (Njanka et al., 2020):

1. Initial / Ad hoc process (where business and IT are not harmonized or aligned);
2. Committed process (where the organization has committed to becoming aligned with IT);
3. Established / Focused process (where the alignment is established between IT and business and focused on business objectives);
4. Improved / Managed process (where the concept of IT as a "Value Centre" is reinforced); and
5. Optimized process (where the strategic planning of business and IT is integrated and reached a co-adaptive stage).

For the full model and elaborations on the attributes related to the levels for each area, see Figure 4-1: SAMM (J. N. Luftman, 2011).

Area	Level	Attributes
Communication maturity: Liaison Effectiveness, Understanding of Business by IT, Understanding of IT Inter/Intra-organizational Learning/Education, Protocol Rigidity, Knowledge Sharing	1	Business/IT lack understanding
	2	Limited business/it understanding
	3	Good understanding; relaxed communications, emerging
	4	Bonding, unified
	5	Informal, pervasive
IT Value measurement/competency maturity: IT Metrics, Business Metrics, Balanced, Metrics, Service Level, Agreements, Benchmarking, Formal, Assessments/Reviews, and Continuous Improvement	1	Some technical measurements
	2	Measures functional cost efficiency
	3	Measures some cost effectiveness; dashboard established
	4	Measures cost effectiveness; some partner value; dashboard managed
	5	Measures extended to external partners
Governance maturity: Business Strategic Planning, IT Strategic Planning, Budgetary Control, Steering Committee(s), Prioritization Process.	1	No formal process, cost centre, reactive priorities
	2	Tactical at functional level, occasionally responsive
	3	Relevant process across the organization
	4	Managed across the organization
	5	Integrated across the firm and partners
Partnership maturity: Business Perception of IT Value, Role of IT in Strategic Business Planning, Shared Goals, Risk, Rewards/Penalties, IT Program Management, Relationship/Trust Style, Business Sponsor/Champion.	1	Conflict; IT is a cost of doing business
	2	IT emerging as an asset; process enabler
	3	IT is as an asset; process driver; conflict seen as creative
	4	IT enables/drives business strategy
	5	IT-business adaptive and improvise together
Scope and architecture maturity: Traditional, Enabler/Driver, External, Standards Articulation, Architectural Integration, Architectural Transparency, Agility, Flexibility, Manage Emerging Technology.	1	Traditional (e.g., accounting, email)
	2	Transactional (e.g., ESS, DSS)
	3	Integrated across the organization
	4	Integrated with partners
	5	Evolve with partners
Skills maturity: Cultural Locus of Power, Change Readiness, Innovation, Entrepreneurship, Management Style, Career Crossover, Training/Education, Hiring and Retaining.	1	IT takes risk, little reward; technical training only
	2	Differs across functional organizations
	3	Emerging value service provider; balanced technical and business hiring
	4	Shared risks and rewards
	5	Education/careers/rewards across the organization

Figure 4-1: SAMM (J. N. Luftman, 2011)

The process of maintaining and improving the alignment between IT-business should be standardized to maximize the strategic alignment. To this end, Luftman & Brier (1999) formulated the six-steps approach as formulated below.

1. Set the goals and establish a team;
2. Understand the business-IT linkage;
3. Analyze and prioritize gaps;
4. Specify the actions (project management);
5. Choose and evaluate success criteria; and
6. Sustain alignment.

4.3. TECHNOLOGY ACCEPTANCE

Technology acceptance has been a recurrent theme for researchers within the academic environment. Consequently, methods describing the phenomena that influence technology acceptance have been proposed. Within this research, the Technology Acceptance Model (TAM) is reviewed and presented to be considered by the adopters of technology.

4.3.1. TECHNOLOGY ACCEPTANCE MODEL (TAM)

In the past three decades, multiple iterations of technology acceptance models have been proposed and researched to verify whether the models can be regarded as economical and valuable, leading to even

more extensions of the models. In other words, TAM caused a trend of researching IS acceptance, increasing our knowledge about the topic. The models are still widely used to evaluate information systems in varied areas because, although IT has shown considerable improvements in the efficiency of businesses, a lot of commitment is needed to realize progress. According to (Agarwal & Prasad (1997), "it must be accepted and used appropriately by its target user group to realize anticipated productivity gains." It is, therefore, essential to understanding when IT can be considered accepted by its target group. To this end, this section introduces the TAM as formulated initially and aims to increase the understanding of the acceptance process.

The TAM is based initially on the socio-psychological theory known as the "Theory of Reasoned Action" (TRA) (Figure 4-2). The TRA was first introduced by Fishbein & Ajzen (1975) to explain an individual's actual behavior based on their intended behavior (L. Li, 2010; Octav-Ionut & Macovei, 2015). Hence, TRA distinguishes the difference between attitude and behavior.

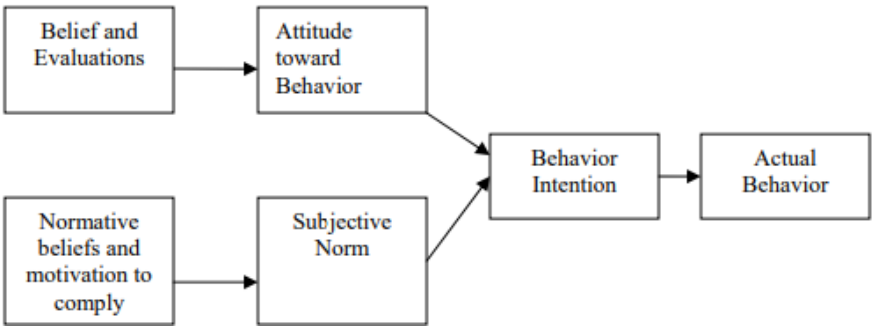


Figure 4-2: Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975)

In the TRA, it is assumed that individuals are rational decision-makers who "constantly calculate and evaluate the relevant behavior beliefs in the process of forming their attitude toward the behavior" (L. Li, 2010). This is also true for the TAM, as it is based on the TRA. Fishbein & Ajzen (1975) define attitude as "an individual's positive or negative feelings (evaluative affect) towards performing the target behavior." In the TAM, attitude is measured from the usage of IS. The TRA is extended to the Theory of Planned Behavior (TPB) (Ajzen, 1991) which served as inspiration for the final version of TAM, as well as TAM 2. Both theories were based on the Social Learning Theory (Bandura, 1977) which studies the environmental and cognitive factors and their interaction with influencing behavior and learning.

The original TAM (Figure 4-3: Original TAM (Davis, 1986)) originated as an adaption of the TRA and was first formulated by Davis (1986). This TAM was designed to model the acceptance of users of IT or IS and turned out to be one of the most influential theories in researching IS. According to (Davis, 1986), perceived usefulness and perceived ease of use are the del's most and second-most essential constructs, respectively. Perceived usefulness is "the extent to which a person believes that using a system will improve his/her job performance" (Venkatesh & Davis, 2000). The perceived ease of use is "the extent to which a person believes that using the system will be free of effort" (Venkatesh & Davis, 2000).

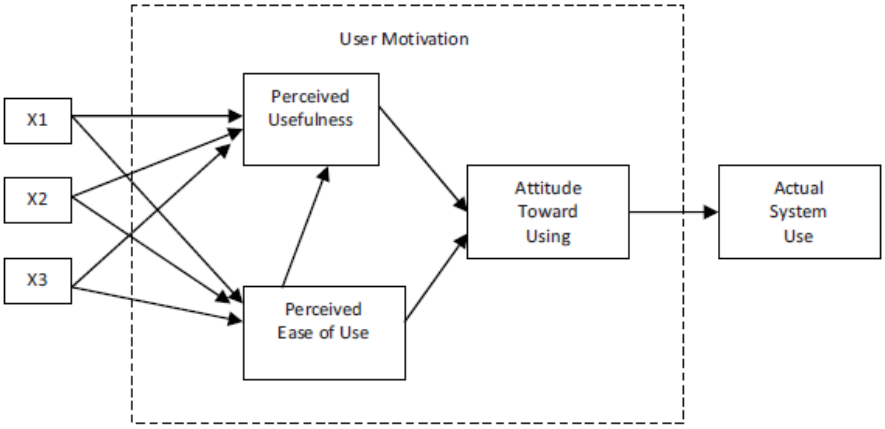


Figure 4-3: Original TAM (Davis, 1986)

The first modification of the TAM recognized the "intention to use" as another relevant construct, meaning it was added to the original model. The final TAM, however, theorizes that behavioral intention is directly determined by the system's perceived usefulness and perceived ease of use. This conclusion led to the final version of the TAM (Figure 4-4: Final version of the TAM (Davis & Venkatesh, 1996).

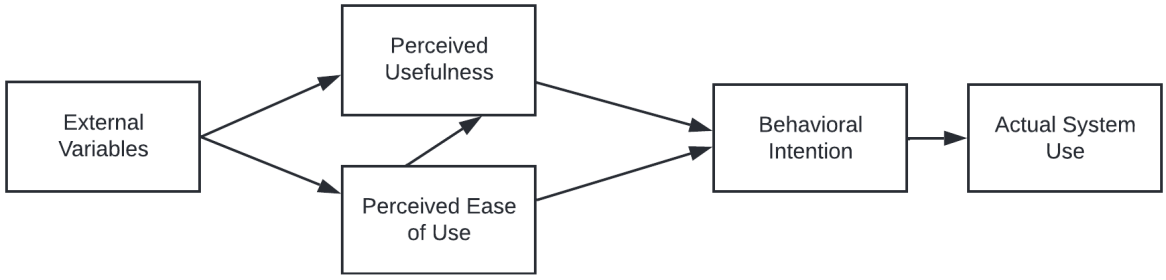


Figure 4-4: Final version of the TAM (Davis & Venkatesh, 1996)

After many empirical tests, it was concluded that perceived usefulness is a powerful determinant of an individual's behavioral intention to use a system. However, the perceived ease of use determinants was not specified before—Venkatesh & Davis (2000 extended the model, including the determinants of perceived usefulness. Understanding these determinants is important because perceived usefulness is a "fundamental driver of usage intentions" (Venkatesh & Davis, 2000). The extension of the TAM includes determinants of social influence processes and cognitive instrumental processes.

The social influence determinants affecting whether a system is perceived as applicable are:

- The subjective norm: "person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975);
- Voluntariness: "the extent to which potential adopters perceive the adoption decision to be non-mandatory" (Agarwal & Prasad, 1997);

- And image: “The degree to which use of an innovation is perceived to enhance one's image or status in one's social system” (Moore & Benbasat, 1991)

The cognitive instrumental processes determinants of whether a system is perceived as applicable are:

- Job relevance: “An individual’s perception regarding the degree to which the target system applies to his or her job” (Venkatesh & Davis, 2000);
- Output quality: The extent to which the system performs tasks well or not;
- Result demonstrability: Tangibility of the results of using the innovation” (Moore & Benbasat, 1991).
- Perceived ease of use: “The extent to which a person believes that using the system will be free of effort” (Venkatesh & Davis, 2000)

TAM 2 includes all determinants within the social influence and cognitive instrumental processes as defined above. For the complete extension of the TAM, see Figure 4-5: TAM 2 (Venkatesh & Davis, 2000) below.

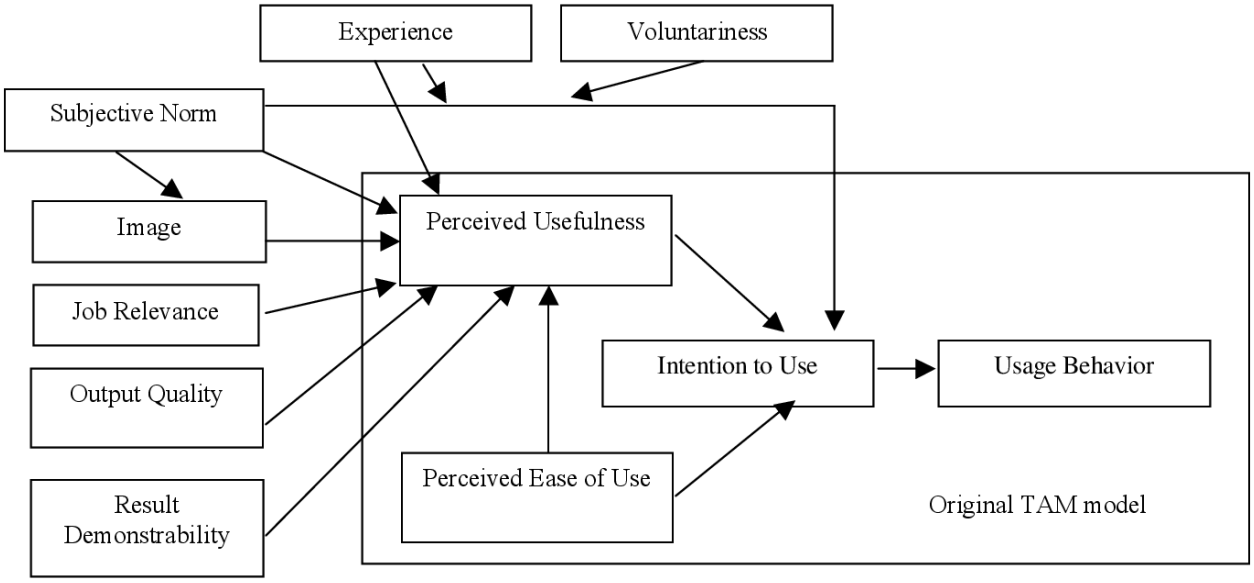


Figure 4-5: TAM 2 (Venkatesh & Davis, 2000)

4.4. CONCLUSION

Within this section, two separate models were proposed that will be used to evaluate the maturity of the information systems of Bender Groep. Firstly, we defined the SAMM as a means to assess the overall maturity of the alignment between IT-business strategy. Secondly, TAM was described as a means to evaluate whether technology is accepted within the organization.

5. INFORMATION SYSTEMS WITHIN BENDER GROEP

Before analyzing the information systems Bender Groep uses, it should be noted that the scope of this research limits the information systems used to the AFAS- and Power BI systems. Although Bender Groep uses multiple systems, these are selected because they are the most relevant in processing information and decision-making processes.

AFAS and Power BI, according to the definitions in the previous chapter, make up the ERP system and BI-system for Bender Groep and are simultaneously examples of OLTP- and OLAP systems, respectively (Eckerson, 2003; Vo et al., 2018). This chapter identifies and describes these information systems and how they should be used. In summary, it describes how raw data should be transformed into valuable insights when using these information systems when aligned.

5.1. AFAS SOFTWARE

The use of AFAS software is analyzed by meeting with employees and researching the AFAS software through the AFAS help center. Next, empirical research is performed to understand the software as much as possible.

The ERP system, which integrates operations within Bender Groep, is provided by AFAS software. AFAS provides ERP solutions for all businesses, which streamlines administrative processes company-wide. It is claimed to be flexible as it can be fine-tuned easily due to standardized packages. These packages have been utilized extensively, resulting in the possibility of selecting best practices. Because of this, industry-specific requirements are recognized and met by the collection of software packages.

5.1.1. TERMINOLOGY IN AFAS

Below is a list of the terminology used within the AFAS software. This list is limited to the terms that are used within this paper.

Citrix: The application that runs behind the Profit name.

Data collection: A gathering of information from tables. It consists of fields from more than one table.

Get connector: Tool in AFAS that allows extracting data out of Profit. The input needed for the tool is one or more fields that need to be extracted

Presentation: This operation can be used to change field names or the presentation of the contents within a field.

Profit database: The single database behind the AFAS ERP system.

View: The retrieving of a data collection to look at its contents.

5.1.2. AFAS ARCHITECTURE

The AFAS software is accessed by any user who the admin of the software authorizes. The software can be accessed through the AFAS online portal or the AFAS pocket app. The first can be accessed through the browser on any desktop, while the latter is accessible from a mobile device. The online portal allows access to Profit (software included in a Citrix application) or AFAS InSite (web application). A 2-factor authentication login procedure secures access to the AFAS software. Next, it is essential to note that the software has a setting in which roles can be distinguished for every user. This enables control of authorizations and access and protects the reliability and validity of all data (as not all data should be accessible by everyone within the company). It also makes the use of AFAS more efficient because not every employee has access to all data, which would make the software unclear for some. The architecture that allows access to data from any desktop or mobile device is summarized in Figure 5-1: AFAS software connections below.

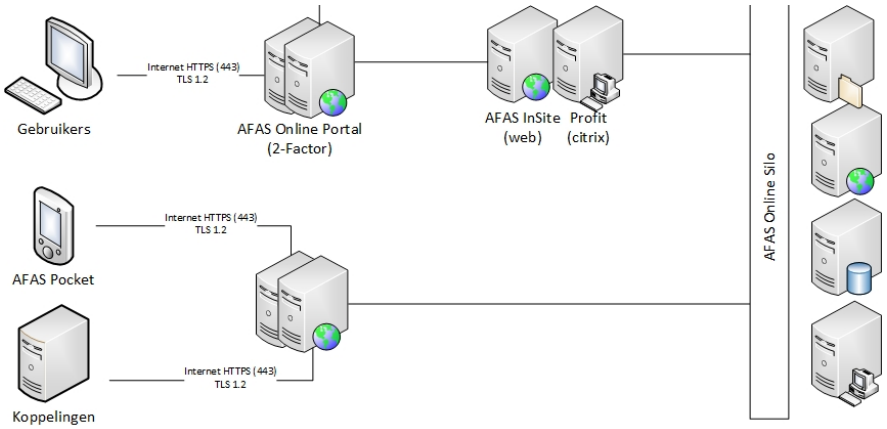


Figure 5-1: AFAS software connections[4]

AFAS software operates from one central database. From this, data is distributed to several data marts for several different business units (e.g., HRM, CRM, Finance, Projects, order management, and fiscal). These data marts can be classified as dependent because the data in them originate from the central Profit database. The description above implies that AFAS software is designed according to a hub-and-spoke architecture. For a brief description of the hub-and-spoke architecture, refer to the definition in section 3.3: Architecture . This architecture assures that the organization only uses an SVOT because the data marts depend on one single, central database. The central database, therefore, functions as the SVOT, while MVOTs are not permitted. This is due to the architecture as described and, more specifically, because the data marts depend on the central database. The architecture does not allow data to be manually added or changed without changing the central database.

As mentioned earlier, AFAS software consists of the AFAS InSite web application and the Profit application from Citrix, which can be accessed through one portal. This sub-section explains these applications in more detail to clarify their distinction. To this end, InSite and Profit will be described individually. After

[4] AFAS software, Architectuur. https://klant.afas.nl/afas-online/architectuur

this, it will be summarized by business process modeling notation (BPMN). This model combines the functionalities of both applications and visualizes when to use which application.

AFAS InSite is used by almost all the internal- and external employees of Bender Groep. It is used primarily for administrative tasks and the display of information. InSite is very user-friendly because of its clear structure. The application is connected to the Profit database so that the Profit application is up to date on all changes within InSite (and the other way around). Changes to data collections to create output are, for example, impossible. Tasks that can be done within InSite include:

- Viewing documents, projects, invoices, analyses, tasks, news, information on colleagues, and hours worked.
- Requesting leave and declaration of hours, kilometers, or other miscellaneous costs.
- Altering of personal information such as a living address and phone number.

Authorizations can be given per individual to increase the efficiency and reliability of the software. These authorizations determine the extent to which an individual can access applications/files. This benefits efficiency because anyone who does not need more information will only need to search longer for the required information. It is also important to note that letting everyone in the organization change/make analyses is not desirable, as this would make the system unreliable. Figure C-1: AFAS InSite homepage shows how the InSite interface looks. The screenshot is taken on the home screen, which is ordered and divided into tabs.

The Profit application is mainly used for analytical purposes. Figure C-2: Profit homepage in the appendix shows the Profit homepage, which, as opposed to the InSite interface, is not as attractive and clean looking. It contains large amounts of data as it does not only show relevant, requested data collections but all data within the database. Functionalities of InSite (e.g., requesting declarations or other miscellaneous costs) require that InSite and Profit are integrated into the same database. This is because data collections from Profit need to be available within its counterpart. This connection forms the basis of the combined functionalities of InSite and Profit alongside each other. However, both applications have different purposes. All functionalities in InSite are part of Profit, but the Profit interface is generally less understandable. The functionalities of Profit are, in addition to the functionalities of InSite:

- Viewing data collections, tables, or output.
- Generating output (using different presentations, calculations, aggregations, filters, etc.).

Figure 5-2: Profit architecture shows how the architecture of Profit links the database with the output. The Profit database contains all data that Bender Groep gathers. Logically, the database consists of tables divided into several fields. Some fields within these tables might be relevant for further analysis. These fields can be selected and aggregated into one data collection, after which that data collection can be modified with customizations, calculations, aggregations, and filters. These modifications eventually lead to the output that is desired.

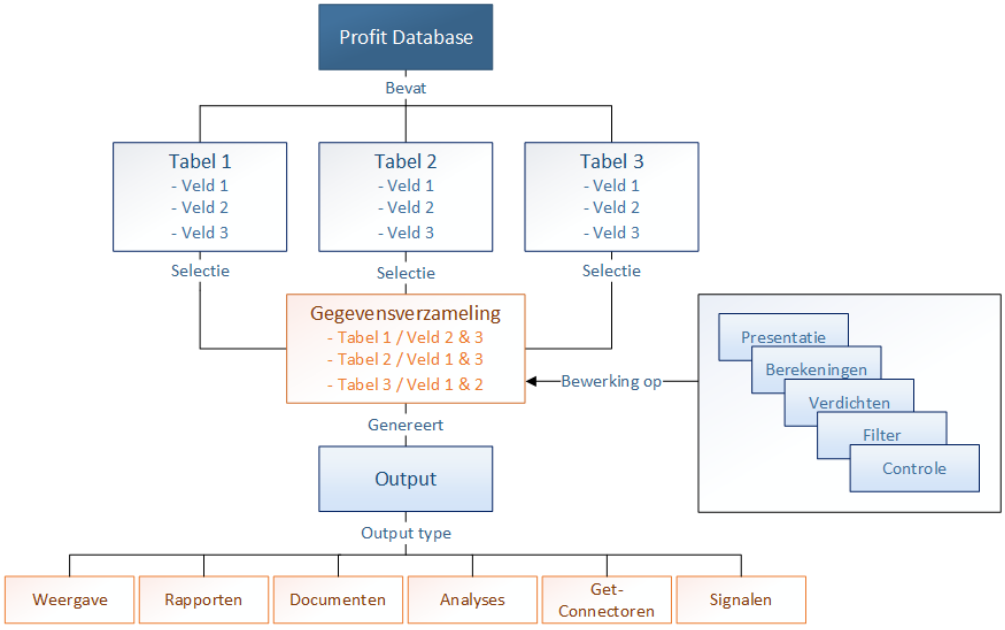


Figure 5-2: Profit architecture [5]

The data stored in the Profit database automatically contains mutual relationships to enable the possibility of creating integrated data collections. Firstly, the AFAS software automatically makes all tables by itself whenever data is put into the system. These are the building blocks that constitute the aggregation of multiple fields. The system also makes these fields into data collections to combine data from several tables. Therefore, data collections are provided by the AFAS software as well. They combine fields from multiple tables into one data collection. This data collection can be modified with several operations. These modifications include calculations, aggregations, filters, checks, and changes in the presentation of the collection. These modifications form the final step that links the Profit database with outputs of AFAS. The outcomes can be in many forms, such as views, reports, documents, analyses, get connectors, and signals.

So, when generating output through the manipulation of data collections, the database is not directly accessed. This is because the database consists of tables, from which fields are aggregated into data collections. These are accessed for the retrieval of data. The advantages of this architecture are that this approach requires less knowledge of the database itself (as it is not directly accessed but grouped into data collection), less room for misinterpretation, and the SVOT is kept throughout the whole organization. The SVOT is, however, challenged by maintaining high flexibility and accessibility, as opposed to the highly flexible MVOTs (which are more prone to misinterpretations and less reliable).

It can be concluded that the procedure of collecting data should consist of the following steps:

1. Select which data collection is needed based on the requirements.
2. Select the fields that are required for output.

[5] AFAS Software, Data collections. https://help.afas.nl/help/EN/SE/App_Query.htm

3. Present field names, as well as their presentation of contents, differently (if desired).
4. Perform calculations if needed.
5. Aggregate data that need to be merged.
6. Apply filter to only show what is required.
7. Check the data collection.

5.2. POWER BI

Next to the ERP system (AFAS), Bender Groep uses power BI tooling. The tooling is explored within this section by studying the application and the learning modules composed by Microsoft.

"Power BI," according to Microsoft, "is a business analytics solution that lets you visualize your data and share insights across your organization or embed them in your app or website.[6]" To make this possible, Power BI contains a collection of software services, apps, and connectors that turn unrelated data collections into one coherent whole. From this, valuable insights can be created that form the basis of data-driven decision-making. Developers that use Power BI do this by following a standard set of activities. This set of activities is explained within this section.

5.2.1. TERMINOLOGY IN POWER BI

App: An organized collection of reports and dashboards with related content. The app assures that all business users work with one single version of the truth (SVOT) and can be made and shared in workspaces within the Power BI service.

Dashboard: Business Intelligence tool visualizing information by displaying key performance indicators on a single screen. A dashboard is made of reports that originate from single datasets (see Figure C-3: Dashboard origin). It allows users to monitor the performance of a particular business (unit) and ensures that all colleagues are on the same page using the same information.

Visualization (or: visual): A display of information. This can be in the form of all kinds of charts, as well as slicers, maps, and many other visuals[7].

Workspace: The work area within Power BI in which content is shared from Power BI with other users within the organization. Every user within a workspace can have different privileges, which the admin organizes. Workspaces can be created from the Power BI service.

5.2.2. POWER BI ARCHITECTURE

Power BI is a collection of software to visualize data and share these insights. The software retrieves data from a data source and enables developers to create insights to support decision-making. These insights

[6] Microsoft, What is Power BI? https://powerbi.microsoft.com/en-us/what-is-power-bi/

[7] Microsoft, Visualization types in Power BI. https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-visualization-types-for-reports-and-q-and-a

are in the form of reports or dashboards, which can be shared easily. To develop them, the Power BI package consists of three applications (the Power BI service is Software as a Service [SaaS]).

As can be seen in the Power BI desktop application, Power BI service, and Power BI mobile make up the complete Power BI software package. These three parts of the business solution co-exist to enable users to create, share, and analyze business insights in the way that suits them and their respective roles. The Power BI desktop is usually used first, followed up by the Power BI service, which is followed up by the Power BI mobile. This is due to the differences in functionalities that the applications have.

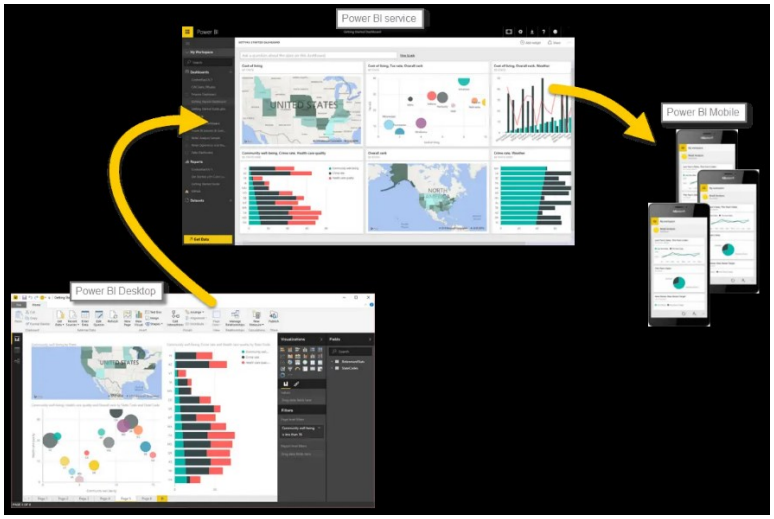


Figure 5-3: Applications of Power BI [8]

The Desktop application connects, transforms, visualizes, and analyzes data[9]. Data can be combined and transformed with calculations, queries, and other means using, for example, query or python code. The desktop application automatically provides a data model of the connected data. The connection to data sources can be made easily for many data sources, while others require a more elaborate procedure. AFAS is used as the primary data source by Bender Groep, which is, unfortunately, one of the databases requiring this procedure to connect. This procedure is documented and explained thoroughly in appendix F: Instructions on the procedure of collecting data in Power BI. The Desktop application also supports the creation and editing of visualizations and reports.

The Power BI service can connect to some data sources, just like the Desktop application, but is less capable of transforming the data (it cannot model the data so that it is combined or transformed in some way). A typical Power BI workflow begins on the Power BI desktop, where reports are made after transforming the data. When considering Figure 5-4: Power BI workflow it can be concluded that these are the first two activities that need to be performed when making valuable insights in Power BI.

[8] Microsoft, Use Power BI. https://docs.microsoft.com/en-us/learn/modules/get-started-with-power-bi/2-using-power-bi

[9] Microsoft, Comparing Power BI Desktop and the Power BI service. https://docs.microsoft.com/en-us/power-bi/fundamentals/service-service-vs-desktop

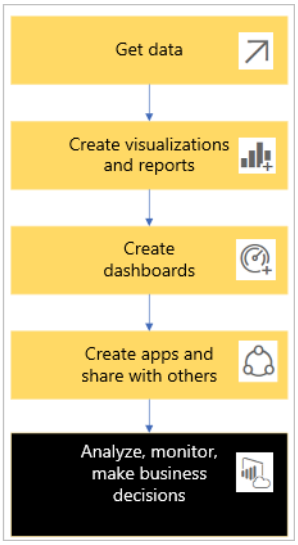


Figure 5-4: Power BI workflow [10]

When these reports are created from their respective datasets, dashboards can be created from one or multiple of these reports. As mentioned, the reports are typically made in the Power BI Desktop (although the Power BI service can edit reports and visualizations as well). Dashboards can, however, not be made in the Desktop application but need to be created in the Power BI service. It can therefore be concluded that after the creation of all visualization and reports needed, there is no need for the Desktop application anymore. The Power BI service has the capabilities to support the subsequent activities in the workflow.

From the definition of dashboards given in section 5.2.1: Terminology in Power BI, it can be verified that from the visualizations and reports created; dashboards can be made. This is done through the Power BI service. The dashboards contain visuals and links to full reports made earlier to bring all relevant information together. After creating all dashboards and reports, they need to be shared. This is done through the Power BI service as well. They can be shared in multiple ways (through an app, link, mail, etc.). These dashboards and reports can be viewed using the Power BI service or through Power BI mobile.

A comparison of the features of the Power BI application and the Power BI service is given in Figure C-4: Venn diagram of the features of the Desktop application and the Power BI service.

Workspaces can be made so that multiple users can access a project. As mentioned in the definition of workspaces, several levels of privilege can be assigned to the user within these workspaces. These have different levels of capabilities and include admins, members, contributors, and viewers. In this way, workspaces support sharing dashboards and reports to any business user without compromising the reliability of the insights shared. These roles logically mean that different users need different features from their software. For example, a “viewer” can only view reports and dashboards, while a developer

[10] Microsoft, Basic concepts for the Power BI service business user. https://docs.microsoft.com/en-us/power-bi/consumer/end-user-basic-concepts#workspaces

that creates business reports and dashboards will, in contrast to a viewer, need to use the Power BI Desktop application.

From a workspace, apps can be made and shared with end users. These apps, containing a collection of reports and dashboards, can be customized and distributed to others. The apps that are created can be installed by:

- Sharing a URL. This installs the app into the Apps section in the Power BI service environment;
- Searching for the app in the "Get apps" section. The app can be found within Apps as well; Or
- By installing the app from iOS, Android, or Windows by clicking the link that can be found in the mail.

5.3. CONCLUSION

Considering the definition from section 3.3.2, it can be concluded that the AFAS and Power BI contain a complete information structure. This is true because the AFAS system functions as the data warehouse and the OLTP system of Bender Groep. Power BI is used as the OLAP system to analyze information and simultaneously the user interface. To summarize, this chapter documents all steps that need to be taken to turn data into valuable insights using the information systems from Bender Groep (AFAS and Power BI). It should be noted that it contains no evaluation of the utilization of the respective information systems. Consequently, this will be the topic of the next chapter.

6. EVALUATION OF THE UTILIZATION OF INFORMATION SYSTEMS

This chapter proposes additions to the documentation of the AFAS software as a result of two meetings with the controller. Additionally, these meetings concluded that Power BI is not integrated well already because it shows that "users are not going to give up their old ways of doing (Eckerson, 2003)." As a result, it is relevant to evaluate the acceptance using the Technology Acceptance Model as proposed in section 4.3: Technology acceptance. Lastly, the overall maturity of the two information systems will be reviewed using the Strategic Alignment Maturity Model from section 4.2.1: Strategic Alignment Maturity Model (SAMM).

The users of the information systems are the management and all other internal employees (see Figure A-1: Organizational chart of Bender Groep). Professionals only use the InSite part of AFAS to declare their hours, request leave, etcetera.

Bender Groep operates in a dynamic market due to the volatility of the job market. The labor market is different over time, changing the position of Bender Groep. The organization has never known a very attacking data strategy, and the primary purpose of its data strategy was to adhere to laws and regulations (section 3.4: Data strategy). Currently, the job market is very tight (UWV, 2022) which is why the sector of secondment is intuitively getting more competitive, however. Because of this, the data strategy is progressively shifting to a more competitive, attacking approach.

6.1. AFAS SPECIFIC EVALUATION

After meeting with the software controller, it can be concluded that there is no documentation of what tasks can be done and how specific tasks can be done in AFAS. Because of this, the previous chapter documented these processes. For the sake of clarity, a BPMN is proposed in Figure 6-1: BPMN of AFAS software.

As described before, both applications (Profit and InSite) can be accessed through the online portal. It is then up to the consumer to choose which application is needed. This can require some knowledge of the functionalities of both applications, which is not always present. As the awareness of the functionalities increases, the efficiency of the ERP system will naturally increase because, inefficiently, trial-and-error is often used when some function is not found directly. This is where the BPMN can help users to see what is sought, as BPMN visualizes the InSite- and Profit applications in terms of functionalities.

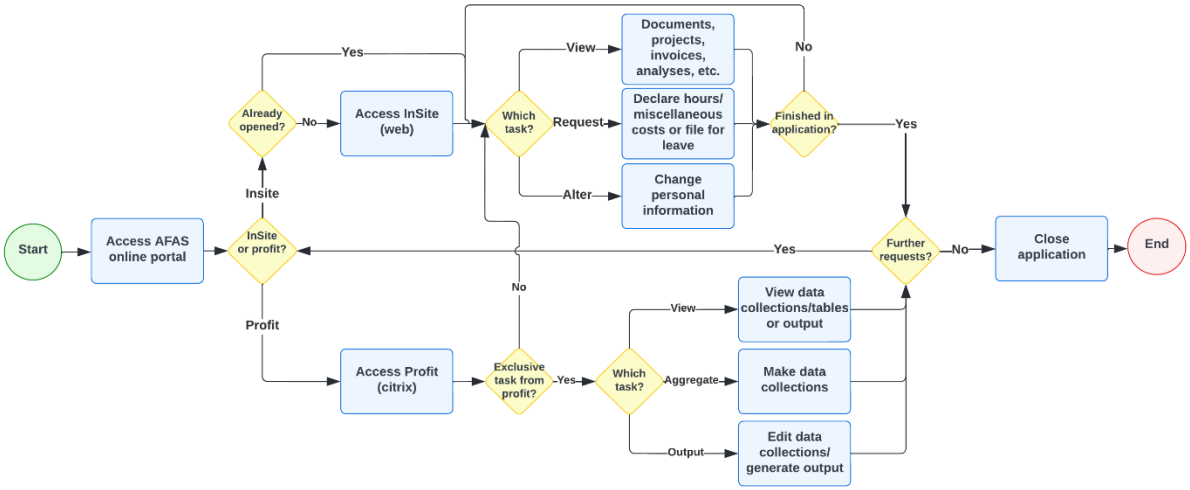


Figure 6-1: BPMN of AFAS software

Besides the implied improvements in efficiency, other miscellaneous advantages of having a BPMN that depicts the situation that the organization finds itself in include:

- The loss of business (process) knowledge is minimized in the case of staff leaving the organization;
- Communication is made more accessible because the BPMN provides a unified language that makes everyone understand the process. This makes the process more transparent;
- Control and consistency of processes are increased because the standard procedure is documented, eliminating guesswork.

From observations and informal meetings with the financial director, controller, administrator, and one other employee, it can be concluded that knowledge of specific business processes often depends on one person. This suggests that the documentation of these processes becomes even more important. Although the BPMN helps to understand the functionalities of AFAS, it is not documenting the internal

structure within the software. As a result, a data model is proposed additionally. For more information on data modeling, please refer to section 3.5: Data modeling.

A visual representation of the architecture behind the data warehousing within the AFAS software is provided by the conceptual data model (Ballard et al., 1998) in Figure 6-2: Conceptual model of the AFAS software.

Note that the central Profit data warehouse model consists of the following four data marts: HRM, CRM, Finance, and Projects, although section 5.1.2: AFAS Architecture concluded that the Profit database consists of six data marts. However, access to the order management and fiscal data marts was not received at the time of writing this paper, meaning that these are purposefully left out of the model.

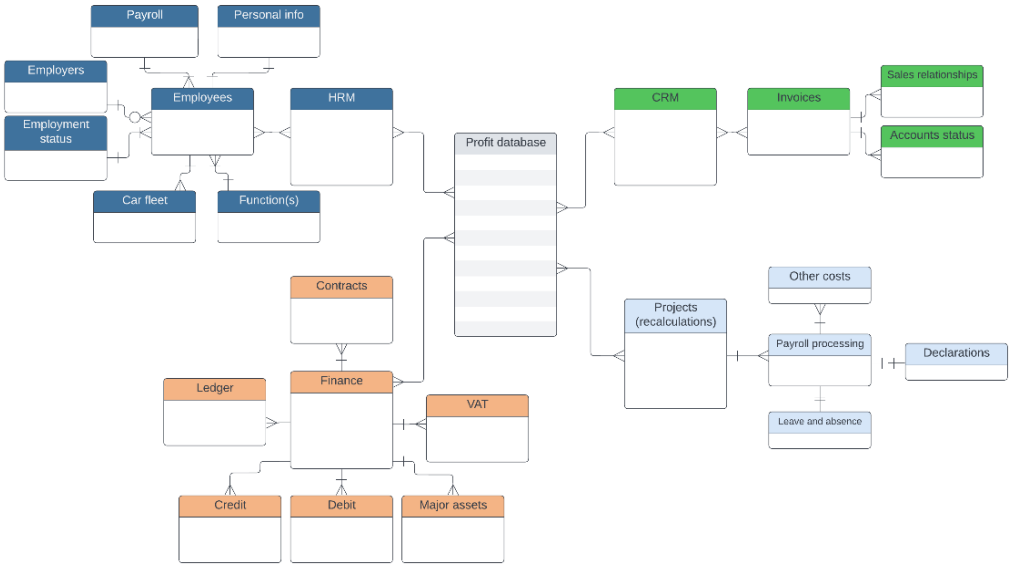


Figure 6-2: Conceptual model of the AFAS software

The model is formulated by reverse-engineering the architecture of the software, meaning that observations of the current software were used to construct the data model. The model can be classified as a conceptual snowflake model (Ballard et al., 1998), as the level of abstractness is high (i.e., details on exact tables are not included). This is because the model is made to increase awareness of existing functionalities and possibilities within the software.

The advantages of the previously stated BPMN directly apply to the data model. The model functions as a tool that documents the elements and relationships of the relational database as designed by AFAS. The data model brings together several aspects of the enterprise to be able to support whatever desired business process requires. It shows the structure from a data-level perspective, helping Bender Groep with insights into the (context of the) available data.

AFAS software is used extensively within Bender Groep. It can be said that every employer uses the software in some way, from registering hours (mainly by professionals) to extracting data to analyze

performance (by the management). Consequently, the BPMN and the data model are mainly of value to the internal employees because they manage the company.

6.2. POWER BI SPECIFIC EVALUATION

Power BI was introduced in September 2021. As a result, it is not accepted by many users, in contrast to the AFAS software. This was concluded after meeting with the controller. Bender Groep is aware that change takes time because, as aforementioned, “users are not going to give up their old ways of doing (Eckerson, 2003). Consequently, the development of more advanced dashboards is put on hold. Besides implementing the technology incrementally, the effort to maximize acceptance should be prioritized. To this end, it is crucial to understand what drives technology acceptance. This section, therefore, evaluates the TAM as proposed in section 4.3: Technology acceptance.

Power BI is implemented recently (late 2021) within Bender Groep. As a result, it is not implemented and accepted as well as the AFAS software. The development of modern visualization aids is not a priority because there is no one with the time to constantly develop, maintain and share reports and dashboards from Power BI. This is because employees have other responsibilities to complete that are perceived as more useful/necessary. The dashboards produced previously are made in the free time of one employee, who is one of the few who understands the functionalities and advantages of Power BI. At the time of writing, the number of reports/dashboards is kept to a minimum for two reasons: As a starting point from which other managers can familiarize themselves with the way of reporting, and because there is not much time for anyone to develop these reports further or to develop more.

6.2.1. EVALUATION OF THE TECHNOLOGY ACCEPTANCE WITHIN BENDER GROEP

Power BI is technologically changing the old way of retrieving information, which can threaten established business models (Lai, 2017; Venkatesh & Davis, 2000). Additionally, this is true when the new technology requires a considerable investment and is underutilized. To this end, effort should be put into managing the acceptance of the technology. The organization should not disregard the importance of understanding the acceptance of the technology, as simply investing in it is not enough for it to be effective. In the previous decades, individual acceptance of information technology (IT) has been a recurrent theme in academic research. The technology acceptance model (TAM) is a product of the research performed in the information systems field.

According to TAM, utilization of technology is determined by the intention of using the technology. Therefore, organizations must understand and create conditions under which their organization embraces and operates the information systems. An individual's intention to use is partly determined by the perceived ease of use but mainly by the perceived usefulness of the system (Venkatesh & Davis, 2000). The determinants that influence the perceived usefulness are therefore included in TAM 2 (Venkatesh & Davis, 2000)and are considered within this sub-section

The acceptance of technology is a problem of social influence, according to the innovation diffusion theory (IDT)[11]. Within TAM 2 (Venkatesh & Davis, 2000)social influence is included as an external factor within the subjective norm determinant of IT acceptance. Among all determinants of IT acceptance, this is the only determinant that is externally influenceable. Because of this, an Elaboration Likelihood Model (ELM) is proposed by Bhattacherjee & Sanford (2006) to evaluate how the subjective norm is influenceable.

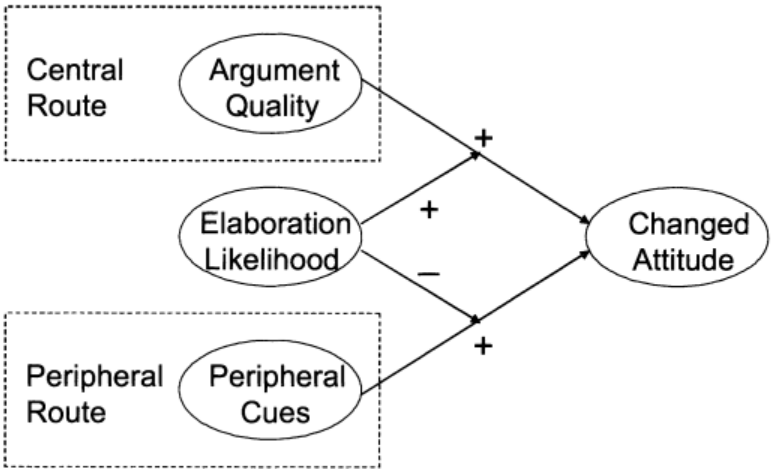


Figure 6-3: Elaboration Likelihood Model (ELM) (Bhattacherjee & Sanford, 2006)

The ELM is an example of a dual-process theory that suggests that, next to the effortful processing of information, there is a less effortful route to persuasion. Consequently, the ELM identifies that attitude change is caused by two routes of influence: The central and peripheral routes. “The central route refers to an individual’s critically cognitive thinking about task-related arguments and relative merits to forming a judgment about the target behavior, while the peripheral route refers to the individual using simple cues or inferences heuristically in evaluating the target behavior, without cognitive thinking” (C. Y. Li, 2013). In other words, persuasion through the central route refers to influence by thoughtful consideration based on the quality of arguments. In contrast, the peripheral route relies on peripheral cues (i.e., emotions and feelings) to persuade the individual (e.g., the source's credibility). As opposed to the central route, the peripheral route requires little cognitive effort.

“Information recipients can vary widely in their ability and motivation to elaborate on an argument's central merits, which in turn may constrain how a given influence process impacts their attitude formation or change” (Bhattacherjee & Sanford, 2006). This phenomenon is captured by the “elaboration likelihood” construct which should be regarded as a temporal state that determines whether an individual possesses the motivation and ability to elaborate on the subject. In other words, whether the individual evaluates the decision based on the central or the peripheral route. The relationships between the central- and

[11] The innovation diffusion theory (…) “originated in communication to explain how, over time, an idea or product gains momentum and diffuses (or spreads) through a specific population or social system. The end result of this diffusion is that people, as part of a social system, adopt a new idea, behavior, or product” (Lamorte, 2019; Rogers, 2003).

peripheral route, elaboration likelihood, and change in attitude are represented in Figure 6-3: Elaboration Likelihood Model (ELM) (Bhattacherjee & Sanford, 2006).

C. Y. Li (2013) suggested that when attempting to persuade staff to adopt new technology, the managers should tailor their persuasive strategy to the elaboration likelihood of their team. So, for staff with a high level of elaboration likelihood, argument quality is essential (e.g., benefits and values of the new system). At the same time, peripheral cues (e.g., expertise and credibility of sources) are more effective for staff with a lower level of elaboration likelihood. However, persuasion through the central route commonly speaks of a long-lasting effect, while the peripheral route is usually only of a short impact. Strong argument quality is, therefore, more effective than relying on peripheral cues.

TAM 2 (Venkatesh & Davis, 2000) identifies eight determinants in total. It was previously mentioned that among all determinants of IT acceptance, the subjective norm is the only determinant that is externally influenceable. Although it can easily be verified that this is true, voluntariness, job relevance, output quality, and perceived ease of use determinants should also be mentioned because of their essential role in the perception of usefulness. The reason for this is that in a meeting with the director, these were recognized as relevant in the case of Bender Groep. The perception of these determinants can be influenced, which is why it is important to note that in this process, the ELM should be taken into account (i.e., adapt persuasion strategy to the individual's elaboration likelihood) to increase the chance of technology acceptance.

6.3. EVALUATION OF THE MATURITY OF IT-BUSINESS ALIGNMENT USING THE SAMM

Within this section, we evaluate the overall maturity regarding the alignment of the IT-business strategy. To this end, the SAMM proposed in section 4.2.1 will be consulted. Note that it is paramount to have an understanding of that chapter before reading this section. At the end of this section, the current state of Bender's alignment maturity will be understood, which will help identify how to proceed.

For this evaluation, the SAMM is reviewed by four users within the internal organization of Bender Groep. These users concern the director, controller, functional manager of AFAS, and HR manager. It is essential for the validity of the assessment that the participants consist of both business and IT representatives. This division is, therefore, 50/50. The results can be found in Table 6-1: Results from SAMM below and are divided into six areas as recognized within the SAMM. Additionally, it should be mentioned that the average results are included within the last column of each area as well.

Area	1	2	3	4	AVG
Communication maturity	4	3	4	3	3.5
Competency/Value measurement maturity	4	2	4	3	3.25
Governance maturity	3	3	4	4	3.5
Partnership maturity	3	2	5	4	3.25
Scope maturity	2	2	5	3	3
Skills maturity	2	2	4	3	2.75

Table 6-1: Results from SAMM

From these results, it can be concluded that the participant's perception of the maturity of the alignment between the IT-business strategy is lowest in scope and skills. Secondly, it should be mentioned that the differences in the opinions indicate that there are opportunities for improving alignment. Consequently, we review the definitions from (Zhou & Cai, 2011) of these areas once more:

- Scope maturity: “The level of flexibility and transparency the IT is providing to business”; and
- Skills maturity: “The level of innovation, change readiness, hiring and retaining, and how they contribute to the overall organizational effectiveness.

These areas will be elaborated on more within this section to enable Bender Groep to understand and improve on these. For this purpose, we review the literature from chapter 4: Literature review on evaluative methods of information systems again.

Scope maturity tends to focus on the maturity of IT specifically. Criteria concerning this area are defined by (J. N. Luftman, 2011). These criteria describe the extent to which IT is capable to:

- Go beyond the back- and front office of the organization;
- Be supportive of a flexible infrastructure that is transparent to partners and customers;
- Evaluate and apply emerging technologies effectively;
- Truly standardize business processes and strategies; and
- Provide customized solutions to different needs.

Skills maturity relates to the human resource considerations of the organizations. Consequently, it concerns the motivation of staff to learn, innovate, and feel responsible. The alignment of staff, management, and business goals is vital to enhance to improve an organization’s skills maturity. Additionally, note that promoting innovative ideas in the spirit of entrepreneurship through compensation plans motivates business units to learn and improve themselves.

7. RECOMMENDATIONS

After working on this research for six months, many concepts regarding information systems, and information technology in general, were researched and evaluated in the case of Bender Groep. The scope of this research was to assess the current IT-business alignment. This evaluation provided the basis with which Bender Groep can improve and, additionally, it functions as evidence illustrating the importance of understanding IT-business alignment. Altogether, this section presents the recommendations that follow from this research.

First, Bender Groep should establish a team that guides the process of aligning IT and business. This team should conduct the funding and prioritization of the matter and guide for improving and maintaining the alignment on an operational level as well. The team should follow the six-step approach from Luftman & Brier (1999), implying that the next step after assembling the team is to organize brainstorming sessions on opportunities and problems identified in the current situation. In addition, a liaison should be appointed to facilitate communication between IT and business. They should organize meetings periodically to align business- and IT strategy by involving both units in decision-making processes. This increases the transparency of both parties.

Besides organizing brainstorming sessions to generate ideas opportunities and problems of the current situation, some recommendations on improving maturity can be made following this research:

1. *Bender Groep should document and standardize their processes*. This way, business knowledge is protected (skills maturity), communication is simplified (communication maturity), and consistency and standardization are enhanced (scope maturity). This research provides documentation in various ways. This was concluded and performed partly in chapters 5 and 6, respectively.
2. M*eetings should be held to review personal specific goals and achievements* to ensure the retainment of staff, as well as alignment on change readiness[12]. Furthermore, a *compensation plan could be implemented to motivate and reward innovation or other accomplishments* (Eckerson, 2003). This would benefit the level of innovation and change readiness (skills maturity), which was concluded to be one of the areas that scores relatively low in the SAMM (chapter 6).
3. As mentioned in the Problem definition (section 1.2.1), business processes are reliant on a few individuals. To improve this, Eckerson (2003) suggests that *users should be involved in "the system's design, data sourcing and validation, and the selection and prototyping of tools and applications."* This way, technology acceptance is more likely and the skills- and communication maturity of the organization improves.
4. *Measure and demonstrate the value of IT to be able to communicate, control, and optimize the current situation* (Scope maturity and IT value measurement/competency maturity). It adds meaning to being "supportive towards a flexible infrastructure that is transparent to partners and

[12] Audigy, Increase Your Business Maturity With These 5 Steps. https://www.audigy.com/blog/increase-your-business-maturity-with-these-5-steps/

customers" (J. N. Luftman, 2011). This recommendation follows the scope maturity score, which scored relatively low in the case of Bender Groep (SAMM, chapter 6).

Furthermore, the acceptance of utilizing Power BI should be planned carefully as underutilizing the technology adds little value to the organization. To this end, trust in the system needs to be built slowly and incrementally to prevent arbitrary deadlines that could cause reasons to undermine the credibility of the system. The mantra in this context is formulated by Eckerson (2003): "Start Small, Grow Big." In the process of implementing technology, Technology Acceptance Model (TAM 2 (Venkatesh & Davis, 2000) should be considered to understand the reasoning behind accepting/not accepting the technology. This research concluded that the determinants that should receive extra attention are: Voluntariness, job relevance, output quality, and perceived ease of use. In addition, the Elaboration Likelihood Model (ELM) (Bhattacherjee & Sanford, 2006)provides insight into influencing the line of reasoning from the potential user.

8. DISCUSSION

The outcomes of this research have provided insight into the maturity of the information systems utilization of Bender Groep and proposed recommendations to enhance it. However, it should be mentioned that these insights should be interpreted with caution because of limitations within this research. This chapter, therefore, discusses this research's limitations, reliability, and validity and the implications they have on the results. Finally, this chapter ends with recommendations for future research.

The results' generalizability (external validity[13]) is limited by the small sample size used in the evaluation. This is because the business control unit is relatively limited in scope. In the research design, however, it was concluded that the number of participants from IT- and the business perspective needs to be evenly distributed. Consequently, the alignment between both parties is assessed from both perspectives. This increases the internal validity[14] of this research because the actual alignment of the information systems utilization is only measured if both views are considered.

Another limitation of this research is that the sample population is subjective. This could lead to untruthful responses. To this end, the purpose of the evaluation is explained and documented (see appendix G: Documented SAMM procedure used).

Additionally, time restrictions limited this research to evaluating the maturity of the information systems utilization instead of improving it. This should be done according to the six steps proposed in chapter 4.2.1. Subsequently, Bender Groep is recommended to put time and effort into the compliance of these steps to achieve a mature IT-business strategy alignment.6.3

9. CONCLUSION

[13] Related to the extent to which it can be applied to other groups of interest (Heerkens & van Winden, 2016)
[14] Whether the research design and measuring instruments used adequately cover what should be answered. (Heerkens & van Winden, 2016)

Within this section, we conclude this paper by answering the main research question formulated within section 1.3. This question was developed to be: “How is the current maturity of the information systems within Bender Groep, and what is it challenged by?”

The maturity of the information systems evaluated (AFAS and Power BI) is already perceived as established by themselves. According to Njanka et al. (2020) (section 4.2.1), scoring a 3 in the evaluation of SAMM relates to an “established/focused process where the alignment is established between IT and business and focused on business objectives”. The challenges for Bender Groep regarding the maturity of their information systems were concluded to lie in the scope- and skill maturity areas: “The level of flexibility and transparency the IT is providing to business” (Zhou & Cai, 2011) and “the level of innovation, change readiness, hiring and retaining, and how they are contributing to the overall organizational effectiveness” (Zhou & Cai, 2011), respectively. Note that the documentation of the processes described in this paper benefits skill maturity.

It should be mentioned that Power BI is less established and is not utilized to its potential because it is implemented incrementaly and carefully (see section 6.2), as the system was only implemented recently (August 2021) while AFAS has been utilized for years. It challenges Bender Groep to implement it so that the technology is accepted. As a result, it was concluded that the company needs to pay attention to the voluntariness, job relevance, output quality, and perceived ease of use determinants for the Technology Acceptance Model.

APPENDIX

A. EXTRA FIGURES CHAPTER 1: INTRODUCTION

Figure A-1: Organizational chart of Bender Groep

B. EXTRA FIGURES CHAPTER 3: LITERATURE REVIEW ON INFORMATION SYSTEMS

Transaction data		*Business intelligence data*
Current	⟷	Historical
Continuously updated	⟷	Periodic snapshots
Source-specific	⟷	Integrated
Application-oriented	⟷	Subject-oriented
Detailed only	⟷	Detailed, summarized, & derived

Figure B-1: Basic design differences between transaction- and BI systems (Eckerson, 2003)

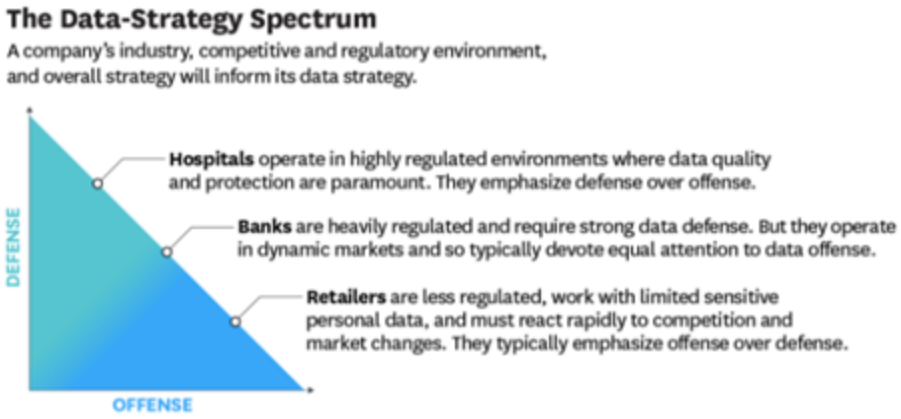


Figure B-2: The data-strategy spectrum (Dallemule & Davenport, 2017)

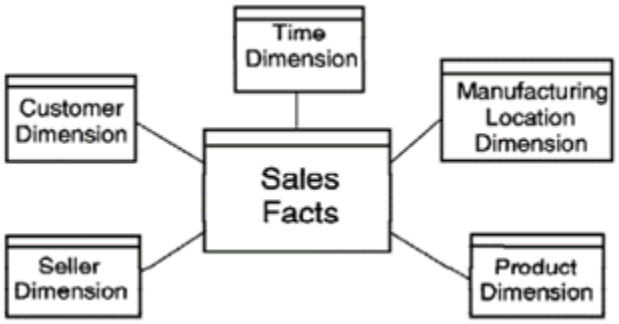


Figure B-3: Star model example from Ballard et al. (1998)

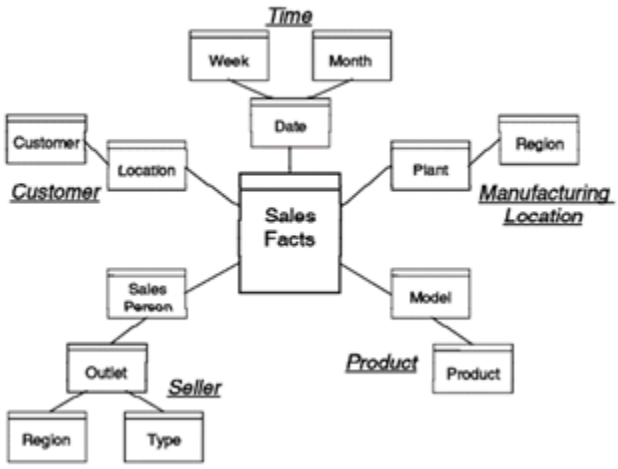


Figure B-4: Snowflake model example from Ballard et al. (1998)

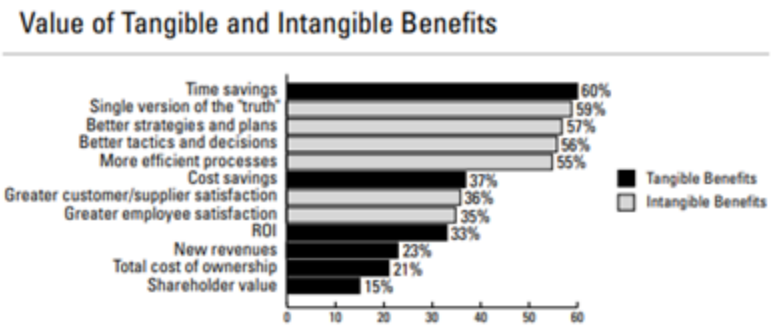


Figure B-5: Survey results on benefits of BI solutions (510 respondents) (Eckerson, 2003, p. 11)

C. EXTRA FIGURES CHAPTER 5: INFORMATION SYSTEMS WITHIN BENDER GROEP

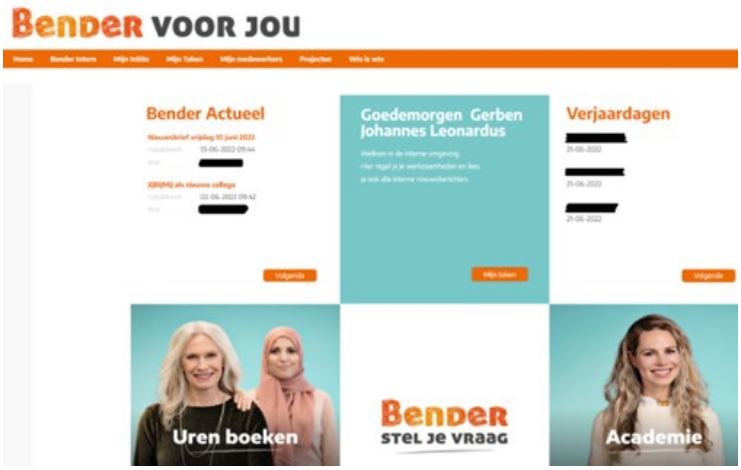


Figure C-1: AFAS InSite homepage

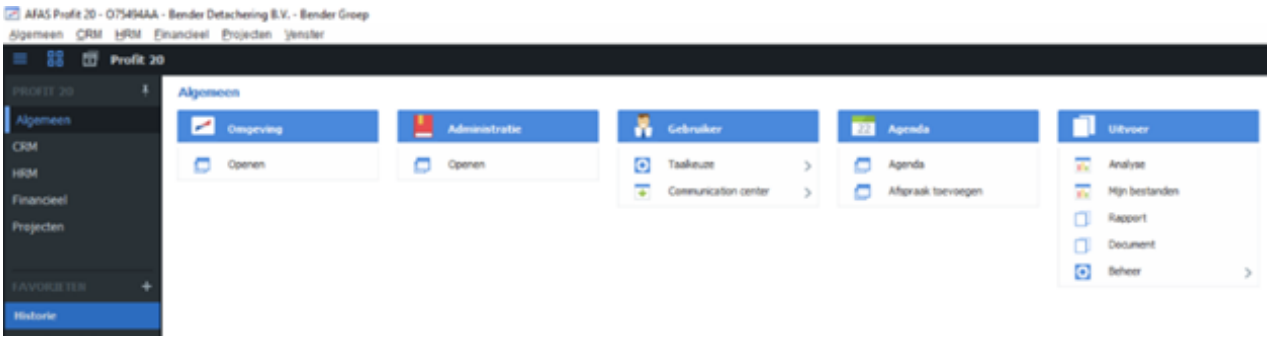


Figure C-2: Profit homepage

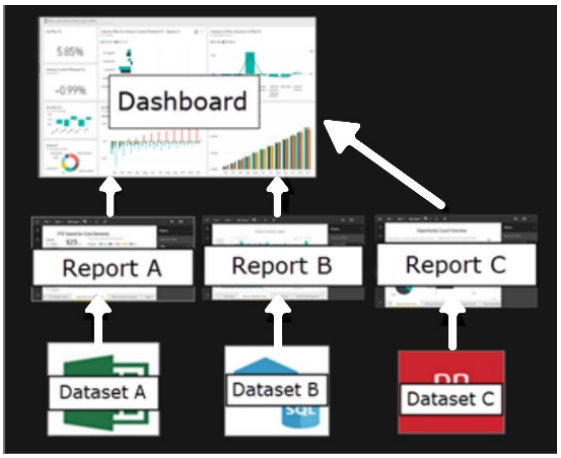


Figure C-3: Dashboard origin

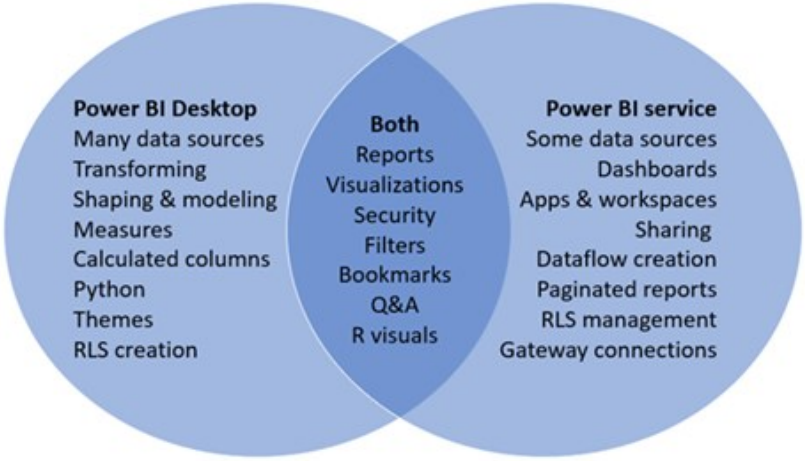


Figure C-4: Venn diagram of the features of the Desktop application and the Power BI service

D. LITERATURE REVIEW ON INFORMATION SYSTEMS PROTOCOL

The inclusion of literature is firstly based on whether the paper contains relevant concepts to be able to answer the knowledge question. These concepts can be found in Table D-1: Search terms. Papers are not included in the paper when not cited (recently) by others, as this is an indicator of the validity of the paper. Next to this, literature is only included when it is fully accessible. This is because both databases show inaccessible papers. The databases used are Web of Science and AMiner, which complement each other because of their different focuses. Web of Science is a multidisciplinary database, while AMiner is focused on computer science. Therefore, search queries need to be different (when the focus is on computer science, the query can be more specific). The method used for this literature review is from R. Cruz (2022).

KEY CONCEPTS	SYNONYMS	CONTEXT
Data organization	Business Intelligence, BI, Business Analytics, Enterprise Architecture,	Business performance management, BPM, Data warehousing, Analytics, Executive Information System

	Enterprise Information Architecture, Data Infrastructure	
Data processing	Data Collection, Data Interpretation	Computation, Excel
Business	Company, Enterprise, Firm, Organization	Sector, Institution, Governmental

Table D-1: Search terms

The literature search will go according to the strategy of refining searches in iterations. This will be based on the number of results, as the number of results can be influenced by refining the search terms and/or filters. The starting point of this review will be broad, after which we can evaluate the results and change the search accordingly.

SEARCH QUERY AND FILTERING	DATABASE	HITS	COMMENTS/RELEVANCE
("Business Intelligence" OR BI OR Business Analytics OR "Enterprise architecture" OR "Enterprise Information Architecture" OR "Data Infrastructure") AND ("Data Processing" OR "Data collection" OR "Data Interpretation") AND (Business OR Company OR Enterprise OR Firm OR Organization) *Filter: None (search in all fields)*	Web of Science	1,514	Already some interesting papers. Can be narrowed down more. Business analytics could be
Add phrase searching for "business analytics" *("Business Intelligence" OR BI OR "Business Analytics" OR "Enterprise architecture" OR "Enterprise Information Architecture" OR "Data Infrastructure") AND ("Data processing" OR "Data collection" OR "Data interpretation") AND (Business OR Company OR Enterprise OR Firm OR Organization)*	Web of Science	1,052	Can still be improved as there are still many irrelevant hits
Query is the same as above! Added filter *("Business Intelligence" OR BI OR "Business Analytics" OR "Enterprise architecture" OR "Enterprise Information Architecture" OR "Data Infrastructure") AND ("Data processing" OR "Data collection" OR "Data interpretation") AND (Business OR Company OR Enterprise OR Firm OR Organization)* *Filter: Search in topic*	Web of Science	368	Still a lot of hits, but many can be regarded as irrelevant after looking at the title
Query is the same as above! Added filter *("Business Intelligence" OR BI OR "Business Analytics" OR "Enterprise architecture" OR "Enterprise Information Architecture" OR "Data Infrastructure") AND ("Data processing" OR "Data collection" OR "Data interpretation") AND (Business OR Company OR Enterprise OR Firm OR Organization)*	Web of Science	5	Few sources left: query can be refined some more

Filter: Search in title			
Changed query: deleted the part (Business OR Company OR Enterprise etc.) *("Business Intelligence" OR BI OR "Business Analytics" OR "Enterprise architecture" OR "Enterprise Information Architecture" OR "Data Infrastructure") AND ("Data processing" OR "Data collection" OR "Data interpretation")* *Filter: In title*	Web of Science	10	Relevant sources remain with a respectable amount of hits
Another database, first query *("Business Intelligence" OR BI OR Business Analytics OR "Enterprise architecture" OR "Enterprise Information Architecture" OR "Data Infrastructure") AND ("Data Processing" OR "Data collection" OR "Data Interpretation")* *Filter: Computer Science Channel*	AMiner	26	Irrelevant papers as they are on a very specific level (not on providing explanations on key concepts)
("Business Intelligence" OR BI OR Business Analytics OR "Enterprise architecture" OR "Enterprise Information Architecture" OR "Data Infrastructure") AND Definition AND Literature *Filter: Computer Science Channel*	AMiner	10	Still very specific papers, but also some relevant

Table D-2: Search log

The accumulated number of hits in the last iterations from Web of Science and AMiner is twenty. Evaluations per search can be found in Table D-2: Search log. The numbers are summarized in Table D-3: Selection of literature below.

NUMBER OF HITS	20
Removing duplicates	-1
Removed based on title and keywords	-7
Removed based on title, keywords, and abstract	-2
Removed after complete reading	-2
Selected for review	**8**

Table D-3: Selection of literature

Finally, Table D-4: Literature included summarizes the papers that are mentioned within the chapter and explains the topic of the respective paper.

Title	Author(s)	Topic
Business Intelligence and Analytics	Bentley, Drew	Business Intelligence and Analytics

Business Intelligence, Analytics, and Data Science: A Managerial Perspective	Sharda, Ramesh Efraim, Turban Delen, Dursun	Several studies have reported a lack of common understanding in EA. This research is an SLR to find explicit definitions.
Defining enterprise architecture: A systematic literature review	Saint-Louis, Patrick Morency, Marcklyvens C. Lapalme, James	A Systematic Literature Review considering journal articles that contain explicit definitions of EA.
Next-generation business intelligence and analytics	Vo, Quoc Duy Thomas, Jaya Cho, Shinyoung De, Pradipta Choi, Bong Jun	Review of the evolution of business intelligence systems from traditional settings.
Smart Companies in the 21st Century: The Secrets of Creating Successful Business Intelligence Solutions	Eckerson, Wayne	Business intelligence solutions in the 21st century
Enterprise Information Infrastructure: An Ideal Framework for Rapid Business System Development	Jiang, Jinlei Jing, Bo Shi, Meinlin	An enterprise information infrastructure that delivers some common functions to management and business, is proposed for software vendors to rapidly develop various enterprise information systems at a cost as low as possible.
Data Modeling Techniques for Data Warehousing	Ballard, Chuck Herreman, Dirk Schau, Don Bell, Rhonda Kim, Eunsaeng Valencic, Ann	Detailed coverage of modeling techniques is presented evolutionarily through a gradual, but well-managed, expansion of the content of the actual data model.
The 2 Types of Data Strategies Every Company Needs	Dallemule, Leandro Davenport, Thomas H.	The authors describe a framework for building a robust data strategy that can be applied across industries and levels of data maturity. The framework will help managers clarify the primary purpose of their data, whether “defensive” or “offensive.”

Table D-4: Literature included

E. LITERATURE REVIEW ON EVALUATIVE METHODS OF INFORMATION SYSTEMS

This literature review follows the same method for performing a literature review as already explained above: The method from R. Cruz (2022).

Before performing the literature review, it is important to define the criteria for inclusion and exclusion. Consequently, the inclusion criteria are defined as follows:

- Papers that discuss the alignment of IT in businesses;
- Papers that focus on the challenges/opportunities in business alignment;
- Papers that are accessible;

While the exclusion criteria are:

- Papers that do not discuss the alignment of IT in organizations
- Inaccessible papers
- Papers that were published before 1995
- Papers that are not cited by others

For this research, the multi-disciplinary database Scopus is used because the topic of interest is multi-disciplinary (it is the bridge between business and IT). Additionally, Scopus is a citation database, meaning that the number of citations is tracked. Lastly, the accessibility of the articles is particularly high when linked with an account from the University of Twente.

KEY CONCEPTS	SYNONYMS/ANTONYMS	CONTEXT
Information systems	IS, Information technology, IT,	IT-business alignment
Business	Company, Enterprise, Firm, Organization	Sector, Institution, Governmental
Growth	Success	Opportunities, Advantages, Disadvantages

Table E-1: Search terms (1)

SEARCH QUERY AND FILTERING	DATA BASE	HITS	COMMENTS/RELEVANCE
("Information Technology" OR "IT" OR "Information System" OR "IS" OR "IT-Business alignment") AND (business OR company OR enterprise OR firm OR organization) AND growth* Filter: None (search in all fields)	Scopus	196, 324	Search needs to be narrowed down because of many irrelevant hits
Query is the same as above! Added filter *Filter: Search in Title*	Scopus	186	Can be improved, many irrelevant hits

			as papers from other fields are found.
** Refined results by limiting search on subject areas.* *TITLE(("Information Technology" OR "IT" OR "Information System*" OR "IS" OR "IT-Business alignment") AND (business OR company OR enterprise OR firm OR organization) AND growth) AND (LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "COMP"))* *Filter: Search in Title and subject areas (Business, Management and Accounting and Computer Science)*	Scopus	94	Still many irrelevant papers.
**Query is the same as above! Refined results by limiting search additional keywords.* *TITLE((“Information Technology" OR "IT" OR "Information System*" OR "IS" OR "IT-Business alignment") AND (business OR company OR enterprise OR firm OR organization) AND growth) AND (LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "COMP")) AND (LIMIT-TO (EXACTKEYWORD,"Information Systems") OR LIMIT-TO (EXACTKEYWORD,"Information Technology") OR LIMIT-TO (EXACTKEYWORD,"Business Growth") OR LIMIT-TO (EXACTKEYWORD,"Growth") OR LIMIT-TO (EXACTKEYWORD,"Information Use"))* *Filter: Search in title, subject areas (Business, Management and Accounting and Computer Science) and keywords (Information Systems, Information Technology, Business Growth, and Information Use)*	Scopus	31	Select group that contains some interesting papers. From this, two are selected
**Query can only serve as input as an “advanced search” because filters were used*			

Table E-2: Search log (1)

Please note that the last two search queries are partly generated by Scopus. Consequently, they can only be used when using the advanced search function in the database.

NUMBER OF HITS	31
Removing duplicates	0
Removed based on title and keywords	-18
Removed based on title, keywords, and abstract	-8
Removed after complete reading	-2
*Added after reading another paper (snowballing)	+2
Selected for review	**5**

Table E-3: Selection of literature (1)

Title	Author(s)	Topic
IT-Business Alignment Strategy for Business Growth	Alsolamy, Afnan A. Khan, Usman A. Khan, P.M.	Alignment of IT and business to achieve growth
IT-Business Alignment: A Systematic Literature Review	Njanka, Samgwa Q. Sandula, Godavari Colomo-Palacios, Ricardo	Literature review into IT-business alignment. Methods of evaluating the IT-business alignment are investigated.
Research on the Measurement of IT-business Alignment	Zhou, Xiaohua Cai, Shuqin	Provides descriptions of IT-business alignment measurements
*Assessing Business-IT Alignment Maturity	Luftman, Jerry	Discusses an approach for assessing the business-IT maturity. This assessment approach is performed within the paper as well.
*Achieving and sustaining business-IT alignment	Luftman, Jerry Bier, Tom	Proposes a systematic approach for achieving and sustaining business-IT-alignment

Table E-4: Literature included (1)

Note that, from the literature review of (Njanka et al., 2020), snowballing was used for one of the papers: (J. N. Luftman, 2011). Consequently, (J. Luftman & Brier, 1999) was used as well.

F. INSTRUCTIONS ON THE PROCEDURE OF COLLECTING DATA IN POWER BI

Stap 1

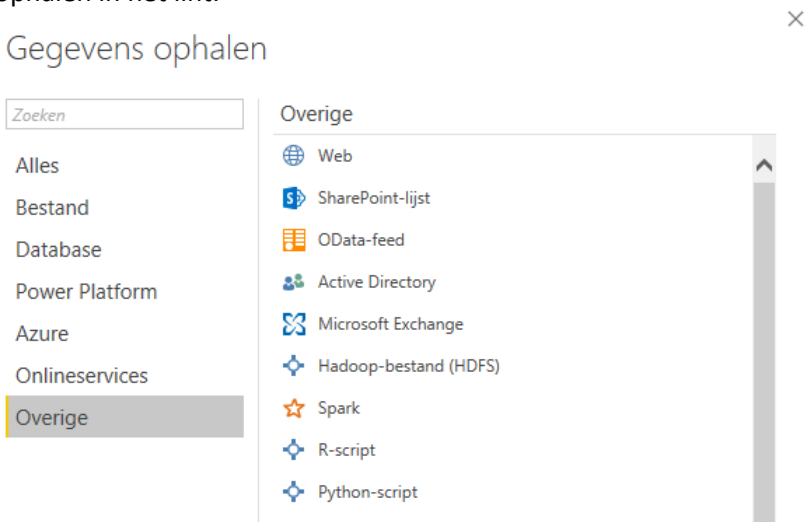
- Prepareer in AFAS Profit een GetConnector, bijvoorbeeld op basis van de nacalculatie, onder Algemeen, Uitvoer, Beheer, GetConnector.
- Zorg dat je voldoende filtering instelt op de gegevensverzameling, zodat je geen onnodige data hoeft in te laden.
- Geef de GetConnector een duidelijke naam zonder spaties. Onthoud deze.

Stap 2

- Maak een app connector aan onder Algemeen, Beheer, AppConnector.
- Ga naar tab ‘GetConnectoren’ en selecteer de zojuist aangemaakte GetConnector in stap 1.
- Ga naar tab ‘Algemeen’ en deblokkeer de App connector.
- Ga naar tab ‘Gebruikerstokens’ en kies nieuw, doorloop de wizard en kopieer de XML-code.
- Zoek online een gewenste Base64 encoder en zet daarmee de XML-code om naar ASCII-tekens.

Stap 3

- Start Power BI Desktop en maak een nieuw bestand.
- Kies Gegevens ophalen in het lint.



- Kies onder Overige voor 'Web'
- Kies Geavanceerd

Stap 4

- Vul bij URL onderdelen de link in naar API, in deze opbouw

Acceptatieomgeving:

https://[omgevingnr].restaccept.afas.online/profitrestservices/connectors/[naamGetConnector]

Productieomgeving:

https://[omgevingnr].rest.afas.online/profitrestservices/connectors/[naamGetConnector]

Testomgeving:

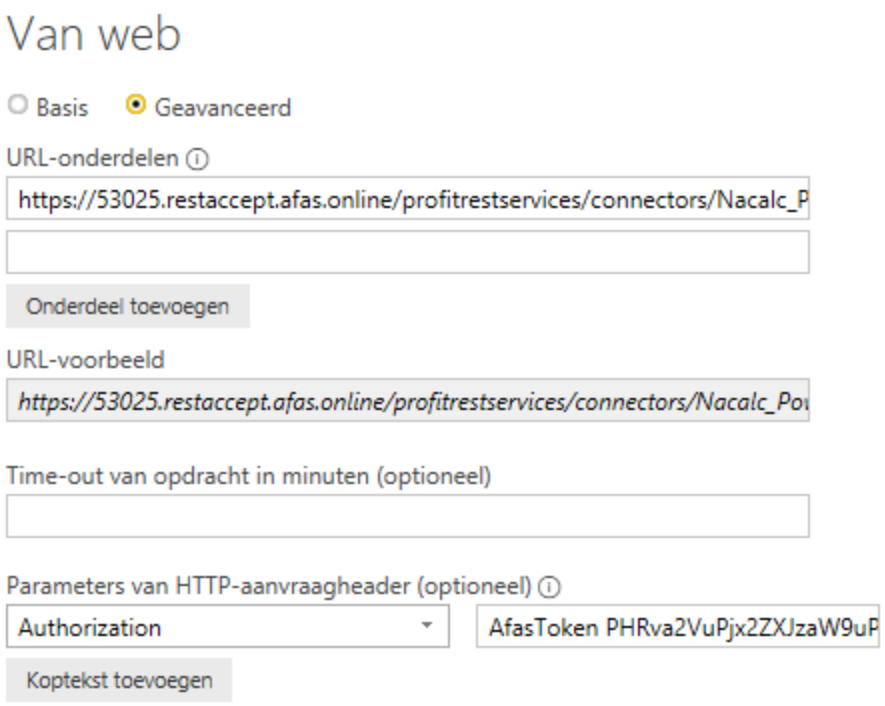
https://[omgevingnr].resttest.afas.online/profitrestservices/connectors/[naamGetConnector]

- De naam van de GetConnector uit stap 1 geef je op het eind van de URL in.

Let op!

Standaard worden er 100 regels opgehaald. Je kunt dit aanpassen voor gebruik te maken van variabelen (skip & take) die je in de URL-aanroep meegeeft. Dit plak je direct achter de URL, bijvoorbeeld ?skip=0&take=1000. De eerste 1000 regels worden dan opgehaald. Door gebruik te maken van ?skip=-1&take=-1 worden alle regels opgehaald. Doe dit alleen als je doeltreffende filtering hebt toegepast op de gegevensverzameling in Stap 1.

Meer info over optimalisatie van performance van de GetConnector vind je hier.



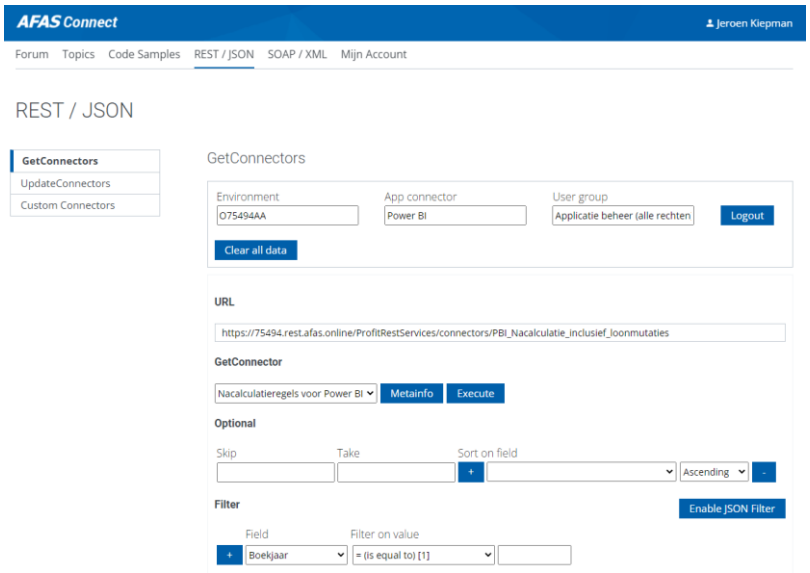
- Geef bij de parameters in de header de waarde op zoals in de afbeelding. Plaats hier de ASCII-gecodeerde variant van de XML-token uit Stap 2.
- En kies OK en voilà.

Stap 5

- Je kunt nu aan de slag met het bewerken van de query, ophalen van achterliggende waarden bij de Arrays en verder transformeren van de data.

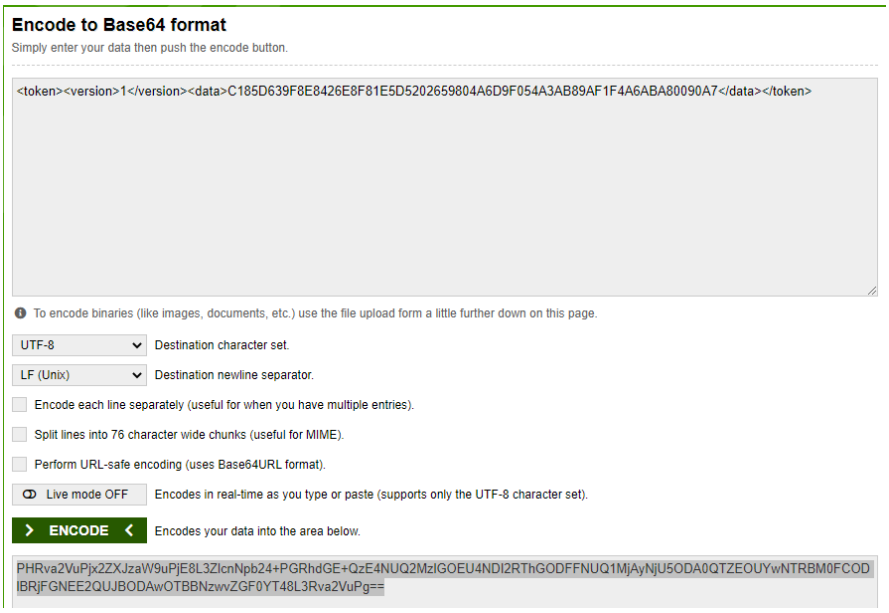
Tools om gegevens te produceren

Stap 1. Produceer URL via AFAS Connect



Stap 2. Encode gebruikerstoken naar Base64 format

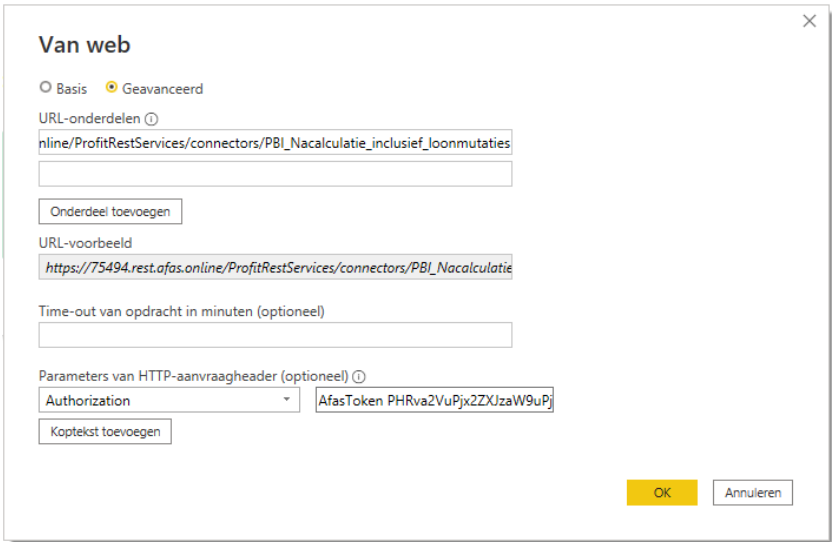
Base64 Encode and Decode - Online

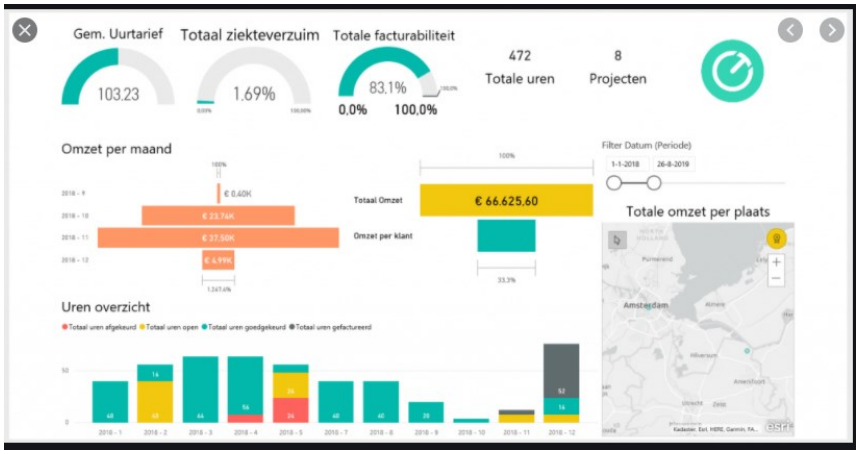


Stap 3. Parameters van HTTP-aanvraagheader

Fill in: Authorization & AfasToken

PHRva2VuPjx2ZXJzaW9uPjE8L3ZlcnNpb24+PGRhdGE+QzE4NUQ2MzlGOEU4NDI2RThGODFFNUQ1MjAyNjU5ODA0QTZEOUYwNTRBM0FCODlBRjFGNEE2QUJBODAwOTBBNzwvZGF0YT48L3Rva2VuPg==


Van web
Basis
Geavanceerd
URL-onderdelen
nline/ProfitRestServices/connectors/PBI_Nacalculatie_inclusief_loonmutaties
Onderdeel toevoegen
URL-voorbeeld
https://75494.rest.afas.online/ProfitRestServices/connectors/PBI_Nacalculatie
Time-out van opdracht in minuten (optioneel)
Parameters van HTTP-aanvraagheader (optioneel)
Authorization
AfasToken PHRva2VuPjx2ZXJzaW9uPj
Koptekst toevoegen
OK
Annuleren


Gem. Uurtarief
103.23
Totaal ziekteverzuim
1.69%
Totale facturabiliteit
83.1%
0.0%
100.0%
472
Totale uren
8
Projecten
Omzet per maand
Totaal Omzet
€ 66.625,60
Omzet per klant
Filter Datum (Periode)
1-1-2018
26-8-2019
Totale omzet per plaats
Amsterdam
Uren overzicht

G. DOCUMENTED SAMM PROCEDURE USED

EVALUATIE VAN DE VOLWASSENHEID VAN DE INFORMATIESYSTEMEN EN DE AFSTEMMING MET HET BEDRIJF

In deze korte evaluatie kijken we naar de volwassen van de informatiesystemen en de afstemming met het bedrijf. Hiervoor bestaat een model die we gaan gebruiken. De uitkomsten zullen bekeken en geanalyseerd worden in mijn onderzoek om de huidige volwassenheid van de informatiesystemen te beoordelen, en zodoende to verbeterpunten te komen.

HET MODEL

Het model bevat levels voor elk gebied. Deze levels zijn uitgelegd als attributen in de laatste kolom. De scores dienen aan het einde van dit document ingevuld te worden.

Area	Level	Attributes
Communication maturity: Liaison Effectiveness, Understanding of Business by IT, Understanding of IT Inter/Intra-organizational Learning/Education, Protocol Rigidity, Knowledge Sharing	1	Business/IT lack understanding
	2	Limited business/it understanding
	3	Good understanding; relaxed communications, emerging
	4	Bonding, unified
	5	Informal, pervasive
IT Value measurement/competency maturity: IT Metrics, Business Metrics, Balanced, Metrics, Service Level, Agreements, Benchmarking, Formal, Assessments/Reviews, and Continuous Improvement	1	Some technical measurements
	2	Measures functional cost efficiency
	3	Measures some cost effectiveness; dashboard established
	4	Measures cost effectiveness; some partner value; dashboard managed
	5	Measures extended to external partners
Governance maturity: Business Strategic Planning, IT Strategic Planning, Budgetary Control, Steering Committee(s), Prioritization Process.	1	No formal process, cost centre, reactive priorities
	2	Tactical at functional level, occasionally responsive
	3	Relevant process across the organization
	4	Managed across the organization
	5	Integrated across the firm and partners
Partnership maturity: Business Perception of IT Value, Role of IT in Strategic Business Planning, Shared Goals, Risk, Rewards/Penalties, IT Program Management, Relationship/Trust Style, Business Sponsor/Champion.	1	Conflict; IT is a cost of doing business
	2	IT emerging as an asset; process enabler
	3	IT is as an asset; process driver; conflict seen as creative
	4	IT enables/drives business strategy
	5	IT-business adaptive and improvise together
Scope and architecture maturity: Traditional, Enabler/Driver, External, Standards Articulation, Architectural Integration, Architectural Transparency, Agility, Flexibility, Manage Emerging Technology.	1	Traditional (e.g., accounting, email)
	2	Transactional (e.g., ESS, DSS)
	3	Integrated across the organization
	4	Integrated with partners
	5	Evolve with partners
Skills maturity: Cultural Locus of Power, Change Readiness, Innovation, Entrepreneurship, Management Style, Career Crossover, Training/Education, Hiring and Retaining.	1	IT takes risk, little reward; technical training only
	2	Differs across functional organizations
	3	Emerging value service provider; balanced technical and business hiring
	4	Shared risks and rewards
	5	Education/careers/rewards across the organization

GEBIEDEN UITGELEGD

- **Communication maturity (communicatievolwassenheid)**: de mate waarin ideeën effectief worden uitgewisseld; Het niveau van begrip van bedrijfsbewustzijn door IT en vice versa;
- **Competency/Value measurement maturity (volwassenheid van competentie/waardemeting)**: "Te veel IT-organisaties kunnen hun waarde voor het bedrijf niet aantonen in termen die het bedrijf begrijpt". Als gevolg hiervan is een dashboard nuttig dat de waarde van IT laat zien. Dit gebied houdt zich dus bezig met de waarde die IT aan het bedrijf bijdraagt;

- **Governance maturity (bestuursvolwassenheid)**: de mate waarin "de juiste deelnemers van het bedrijf en IT de prioriteiten en de toewijzing van IT-middelen herzien";
- **Partnership maturity (partnerschapsvolwassenheid)**: bedrijfsperceptie van de waarde van IT. Het gaat dus om de bereidheid van deelnemers om de risico's/voordelen van de technologie te delen (Zhou & Cai, 2011);
- **Scope maturity (scope volwassenheid)**: "De mate van flexibiliteit en transparantie die IT biedt aan bedrijven"; en
- **Skills maturity (vaardighedenvolwassenheid)**: "Het niveau van innovatie, veranderingsbereidheid, aanwerving en behoud, en hoe deze bijdragen aan de algehele effectiviteit van de organisatie".

ATTRIBUTEN UITGELEGD

De attributen staan in het model kort uitgelegd. Als er eentje niet duidelijk is, onthoud dat de attributen over het algemeen de volgende verdeling kennen:

1. Initieel / Ad hoc proces (waar business en IT niet op elkaar zijn afgestemd of op elkaar zijn afgestemd);
2. Toegewijd proces (waarbij de organisatie zich heeft gecommitteerd om op één lijn te komen met IT);
3. Gevestigd / gericht proces (waar de afstemming tot stand is gebracht tussen IT en business en is gericht op bedrijfsdoelstellingen);
4. Verbeterd / beheerd proces (wanneer het concept van IT als een "waarde middelpunt" wordt gebruikt en behouden);
5. Geoptimaliseerd proces (wanneer de strategische planning van business en IT is geïntegreerd en een co-adaptief stadium heeft bereikt)

SCORES HIER INVULLEN

Gebied	1	2	3	4	5
Communication maturity (communicatievolwassenheid)					
Competency/Value measurement maturity (volwassenheid van competentie/ waardemeting)					
Governance maturity (bestuursvolwassenheid)					
Partnership maturity (partnerschapsvolwassenheid)					
Scope maturity (scope volwassenheid)					
Skills maturity (vaardighedenvolwassenheid)					

REFERENCES

Agarwal, R., & Prasad, J. (1997). The Role of Innovation Characteristics and Perceived Voluntariness in the Acceptance of Information Technologies. In *Decision Sciences* (Vol. 28).

Ajzen, I. (1991). *The Theory of Planned Behavior*.

Alsolamy, A. A., Khan, U. A., & Khan, P. M. (2014). IT-business alignment strategy for business growth. *2014 International Conference on Computing for Sustainable Global Development, INDIACom 2014*, 364–366. https://doi.org/10.1109/IndiaCom.2014.6828160

Ballard, C., Herreman, D., Schau, D., Bell, R., Kim, E., & Valencic, A. (1998). *Data Modeling Techniques for Data Warehousing*. http://www.redbooks.ibm.com

Bandura, A. (1977). *Social Learning Theory* (1st ed.). N.J.: Prentice-Hall.

Bentley, D. (2017). *Business Intelligence and Analytics* (Vol. 318).

Bhattacherjee, A., & Sanford, C. (2006). *Influence Processes for Information Technology Acceptance: An Elaboration Likelihood Model* (Vol. 30, Issue 4).

Cruz, R. (2022). *Template - Setting up your systematic search strategy*.

Dallemule, L., & Davenport, T. H. (2017). The 2 Types of Data Strategies Every Company Needs. *Harvard Business Review*, *15*(1). https://hbr.org/2017/05/whats-your-data-strategy

Davis, F. D. (1986). *A technology acceptance model for empirically testing new end-user information systems: Theory and results.* : Sloan School of Management.

Davis, F. D., & Venkatesh, V. (1996). *A model of the antecedents of perceived ease of use: Development and test.* (3rd ed., Vol. 27). Decision Sciences.

Eckerson, W. (2003). *Smart Companies in the 21st Century: The Secrets of Creating Successful Business Intelligence Solutions*. www.dw-institute.com

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behaviour: An introduction to theory and research*. Addison-Wesley.

Furner, J. (2020). Definitions of "Metadata": A Brief Survey of International Standards. *Journal of the Association for Information Science and Technology*, *71*(6), E33–E42. https://doi.org/10.1002/asi.24295

Heerkens, H., & van Winden, A. (2016). *Solving Managerial Problems Systematically* (1st ed.). Noordhoff Uitgevers.

Jiang, J., Jing, B., & Shi, M. (2008). Enterprise Information Infrastructure: An Ideal Framework for Rapid Business System Development. In *LNCS* (Vol. 5236).

Lai, P. (2017). The literature review of technology adoption models and theories for the novelty technology. *Journal of Information Systems and Technology Management*, *14*(1). https://doi.org/10.4301/S1807-17752017000100002

Lamorte, W. W. (2019, September 9). *Behavorial change models: Diffusion of Innovation Theory*.

Li, C. Y. (2013). Persuasive messages on information system acceptance: A theoretical extension of elaboration likelihood model and social influence theory. *Computers in Human Behavior*, *29*(1), 264–275. https://doi.org/10.1016/j.chb.2012.09.003

Li, L. (2010). *A Critical Review of Technology Acceptance Literature*.

Luftman, J., & Brier, T. (1999). Achieving and sustaining business-IT alignment. *California Management Review*, *1*, 109–122. https://doi.org/10.2307/41166021

Luftman, J. N. (2011). Assessing Business-IT Alignment Maturity. In *Strategic Information Technology*. IGI Global. https://doi.org/10.4018/9781878289872.ch006

Moore, G. C., & Benbasat, I. (1991). *Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation.* (3rd ed., Vol. 2). Information Systems Research.

Njanka, S. Q., Sandula, G., & Colomo-Palacios, R. (2020). IT-Business Alignment: A Systematic Literature Review. *CENTERIS - International Conference on ENTERprise Information Systems*.

Octav-Ionut, M., & Macovei, O.-I. (2015). *Applying the Theory of Planned Behavior in Predicting Pro-environmental Behaviour: The Case of Energy Conservation*. https://www.researchgate.net/publication/284014676

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.

Saint-Louis, P., Morency, M. C., & Lapalme, J. (2017). Defining enterprise architecture: A systematic literature review. *Proceedings - IEEE International Enterprise Distributed Object Computing Workshop, EDOCW*, *2017-October*, 41–49. https://doi.org/10.1109/EDOCW.2017.16

Sharda, R., Turban, E., & Delen, D. (2017). *Business Intelligence, Analytics, and Data Science: A Managerial Perspective* (D. King, Ed.; 4th ed., Vol. 512). Pearson Education Limited.

UWV. (2022, August 13). *Arbeidsmarkt in Nederland voor het eerst zeer krap*.

Venkatesh, V., & Davis, F. D. (2000). Theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. *Management Science*, *46*(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926

Vo, Q. D., Thomas, J., Cho, S., De, P., & Choi, B. J. (2018). Next generation business intelligence and analytics. *ACM International Conference Proceeding Series*, 163–168. https://doi.org/10.1145/3278252.3278292

Zhou, X., & Cai, S. (2011). Research on the measurement of IT-business alignment. *International Conference on Management and Service Science, MASS 2011*. https://doi.org/10.1109/ICMSS.2011.5998584