

Enhancing Performance Measurement in the Dutch Construction Industry: Integrating the Balanced Scorecard and Business Intelligence & Analytics Systems

A Design-Oriented Case Study for Data-Driven Performance Management

Master of Science (MSc) Business Administration: Digital Business & Analytics

University of Twente

J.T. Holtmaat

Examination committee:

First supervisor: *Dr. Ir. E. Hofman*

Second supervisor: *Dr. M. de Visser*

23-6-2025

Master Thesis Research Project

Title: Enhancing Performance Measurement in the Dutch Construction Industry:
Integrating Balanced Scorecard and Business Intelligence Analytics Systems

Date: 23-6-2025

Version: Master Thesis Research Project

Author:

Author: J.T. Holtmaat

Programme: MSc Business Administration

Specialization: Digital Business & Analytics

Faculty: Behavioural, Management and Social sciences (BMS)

Institute: University of Twente

1st supervisor

Dr. Ir. E. Hofman

Organization: University of Twente

Faculty: Behavioural, Management and Social sciences (BMS)

Department: Entrepreneurship, Technology, Management (BMS-HBE-ETM)

2nd supervisor:

Dr. M. de Visser

Organization: University of Twente

Faculty: Behavioural, Management and Social sciences (BMS)

Department: Entrepreneurship, Technology, Management (BMS-HBE-ETM)

Acknowledgments

First of all, I would like to thank the company for offering me the opportunity to graduate from their company. I am particularly grateful to my external supervisor for his guidance and expertise throughout the research process.

Furthermore, I would like to thank Dr. Ir. Erwin Hofman and Dr. Matthias de Visser for their supervision, critical view, and educational insights, helping me to not only finalize my master thesis, but also giving me valuable advice for the future after graduation.

Also, my gratitude goes to the interviewees, workshop participants, and other participants related to my research for their participation and insights, helping me to conduct my research. This applies also to other colleagues within the company who supported me throughout the research phases.

Lastly, I would like to thank my friends and family for their guidance and support throughout my studies.

During the preparation of this work, the author used generative AI to gain an initial understanding of key topics in this research, suggest synonyms to use in text, and propose refinements for grammar, spelling, and structure of the work. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the work.

Abstract

The construction industry lags behind other industries in adopting balanced, long-term performance measurement systems. As a result, the construction industry remains focused on financial, short-term-oriented indicators evaluating strategy execution performances. Furthermore, although the growing importance of data is recognized within the industry, integrating performance measurement systems and Business Intelligence and Analytics (BI&A) systems in literature remains scarce.

This research investigates how the Balanced Scorecard, a balanced performance measurement system, can be applied in a mid-sized Dutch construction company, supported by Business Intelligence and Analytics systems, to enhance performance management processes.

A case study using a design research approach was conducted, delivering a final design based on a stepwise, transparent, and user-oriented research process.

The findings present the outcome of the design research process: a Balanced Scorecard tailored to the company's strategy. The use of a strategic linkage model and destination statements particularly improved the scorecard design process, presenting cause-effect relationships and quantifiable objectives supported by time goals. The BI&A architecture improves data availability and accessibility, automating collection, analysis, and reporting processes. Applying the Balanced Scorecard in the construction industry highlights the industry-specific characteristics, tradeoffs, limitations, and advantages. The study suggests that future research should focus on integrating advanced data analytics and visualization techniques into the Balanced Scorecard, expanding the performance measurement system with predictive and prescriptive insights.

This study contributes to theory by presenting a translation of Balanced Scorecard and BI&A theories into practice in construction performance management processes. The design process provides practical value, as other mid-sized construction companies can replicate the design process, enhancing balanced performance measurement and BI&A adoption in the construction industry.

Keywords: Performance Measurement; Balanced Scorecard; Business Intelligence & Analytics; Construction industry; Design Research

Table of contents

Acknowledgments	
Abstract	
1 Introduction	4
2 Theory	10
2.1 Performance measurement systems.....	10
2.1.1 Balanced Scorecard	11
2.1.2 Alternative balanced performance measurement systems	13
2.1.3 Balanced Scorecard application	15
2.1.4 Balanced Scorecard critics	17
2.2 Business Intelligence and Analytics	20
2.2.1 Conceptualization of Business Intelligence.....	21
2.2.2 Conceptualization of Business Analytics	24
2.3 Balanced Scorecard in BI&A architecture	27
3 Methodology	28
3.1 Research design.....	28
3.2 Case selection and sample	29
3.2.1 Case selection	29
3.2.2 Research units.....	29
3.3 Data collection.....	31
3.4 Data analysis	32
3.5 Design, prototyping, and final design.....	34
3.6 Ethical considerations.....	35
4 Results	36
4.1 Phase 1: Business needs	36
4.1.1 Performance measurement	36
4.1.2 Balanced Scorecard perspectives	38
4.2 Phase 2: Current performance measurement & BI&A architecture	45
4.2.1 Current performance measurement	45
4.2.2 Relevant performance indicators from literature.....	48
4.2.3 BI&A architecture	48
4.3 Phase 3: Design specifications	53
4.3.1 Performance measurement specifications	53
4.3.2 Balanced Scorecard specifications	55
4.4 Phase 4: System-level design & prototype.....	57
4.4.1 Balanced Scorecard design.....	58
4.4.2 BI&A architecture design	61

4.4.3 Prototype design evaluation	62
4.5 Phase 5: Final specifications & final design.....	63
4.5.1 Final specifications.....	63
4.5.2 Final design	66
4.5.3 Final design evaluation.....	74
5 Discussion	75
5.1 Discussion and analysis.....	75
5.2 Theoretical implications.....	78
5.3 Practical implications	78
5.4 Limitations and recommendations for future research	79
6 Conclusion.....	80
7 Reference list.....	81
8 Appendix	89
Appendix A – Interview Guide (Dutch)	89
Appendix B – Business needs template.....	92
Appendix C – Informed Consent sheet (Dutch).....	93
Appendix D – Interpreted business needs	96
Appendix E – Literature-Based Performance Indicators.....	99
Appendix F – Balanced Scorecard voting outcome	103
Appendix G – Prototype design calculations & definitions	104

1 Introduction

Through the rapid development of technologies, society and its industries are flooded with an increasing amount of available data (Bilal et al., 2016; Golazad et al., 2024). Data analysis, which is the process of analyzing the collected data, generates valuable business information and insights for the management of organizations, for example, through tabular reports or graphs (Lopes & Boscaroli, 2020). This information is an important factor for decision-making and management in companies (Provost & Fawcett, 2013; Sharda et al., 2014). The growing amounts of available data require state-of-the-art analytical systems and methods that can process this data to generate the desired information for data-driven decision-making and management control (Bilal et al., 2016; Golazad et al., 2024).

A common tool that supports decision-making and management control is called a performance measurement system (Bititci et al., 2000). A performance measurement system consists of a predefined set of indicators measuring organizational performance based on collected organizational data. By reporting the measurements and reviewing the performance for each indicator, the management of an organization can base their decision-making on different aspects of the organization (Neely et al., 2005). Performance measurement systems are historically developed to get a balanced interplay between financial and non-financial indicators measuring organizational performance (Giannopoulos et al., 2013; Pinheiro de Lima et al., 2013; Zheng et al., 2016).

The sets and types of indicators organizations adopt to measure organizational performance are mostly based on the organization's strategy, business environment, and objectives (Davis & Albright, 2004; Neely et al., 2005). Various researchers have provided literature with specific performance measurement systems that each take different perspectives on the performance measurement of organizations. The Performance Measurement Matrix of Keegan et al. (1989) was one of the first widely adopted performance measurement systems, using a cost-based perspective. Nowadays, one of the most commonly applied performance measurement systems among industries is the Balanced Scorecard (BSC) by Kaplan and Norton (1992), addressing financial, customer, innovation/learning, and internal business perspectives to assess organizational performance (Kumar et al., 2024; Sharda et al., 2014). Kaplan and Norton (1996) called the scorecard 'balanced,' arguing that no single perspective could measure an organization's entire performance. Also, the Balanced Scorecard focuses on organizational vision and strategy rather than financial control, resulting in a multiple-perspective performance analysis (Kaplan & Norton, 1992).

The Dutch construction industry directly accounts for approximately 5.04% of the produced Gross Domestic Product (GDP) in 2023 (CBS, 2024). The industry is mainly driven by temporary, non-repetitive works and projects (Dubois & Gadde, 2002; Lopes & Boscaroli, 2020). Additionally, the different actors, their cooperation, and the diversity of specializations used in specific construction projects further characterize the construction industry (Baccarini, 1996; Fernandez-Solis, 2008). As a result of the unique characteristics of the construction industry, the various shapes and amounts of data that emerge from those works and projects require specific analytical tools (Forcael et al., 2020).

Although many other industries are well-developed, researchers argue that the construction industry is yet to fully explore the potential and benefits of performance measurement systems (Harris et al., 2020; Holt, 2000; Nudurupati et al., 2007). Companies in the industry especially measure performance through financial indicators, while paying less attention to other factors (Dobrovič et al., 2018). For example, return on investment (ROI) and profitability remain important indicators (Bondinuba et al., 2023; Holt, 2000; Nudurupati et al., 2007). Although the emphasis on non-financial performance measurement in publications has increased in recent years, others present support that the construction industry is still catching up with other industries in adopting non-financial indicators in their performance measurement systems (Ibrahim et al., 2024; Murguia et al., 2022). Abu Oda et al. (2022) explored the current use of key performance indicators (KPIs) in construction companies in the Gaza

Strip. They concluded that indicators were mostly aimed at cost, time, and quality indicators relating to projects. Other publications also identified this short-term focus, addressing the need for long-term sustainable performance indicators (Rajabi et al., 2022).

Relying primarily on financial and time performance indicators has shortcomings for the long-term performance of construction companies, as indicated in other business sectors (Bititci et al., 2000; Ibrahim et al., 2024). Furthermore, it is well-known among industries that using a balanced, uniform performance measurement system increases business performance (Nudurupati et al., 2007). Both concerns address the need for more research into the use of a balanced performance measurement system (e.g., the Balanced Scorecard) in the construction industry.

Performance measurement systems go hand in hand with big data and data analytics developments, which are also noticeable in the construction industry (Bilal et al., 2016). Gigantic amounts of data are generated throughout a building's entire life cycle (Bilal et al., 2016). In the Global Construction Survey by KPMG, the use of advanced data analytics and basic data analytics were both in the top five most responded technologies with the potential to deliver the greatest overall Return on Investment (ROI) for 2023, 2021, and 2018, respectively (KPMG-LLP, 2023). This indicates an industry-wide recognition of the potential of data analytics as a valuable technology. However, as the construction industry generates great volumes of data, the smart data processing technologies in the construction industry have not reached the progress achieved in other industries (Hwang et al., 2022; Ram et al., 2019; Singh et al., 2024). So, apart from the industry-wide recognition of the potential of analytics, recent publications encourage expanding data analytics research in the construction industry.

Literature provides various definitions that capture data analytics elements, such as decision support systems (DSS), Big Data Analytics (BDA), or Business Intelligence (BI). However, this research uses Business Intelligence and Analytics (BI&A) as an overarching concept to capture (big) data analytics, intelligence, and other related fields into one term (Andoh-Baidoo et al., 2022; Chen et al., 2012; Clark et al., 2007). BI&A encompasses a package of tools, applications, technologies, and processes for gathering, storing, accessing, and analyzing data to generate useful business information to support decision-making (Moreno et al., 2020; Wixom & Watson, 2010). The BI&A environments consist of data sources, a data warehouse environment, a data analytics environment, performance and strategy criteria, and a user interface, representing the entire BI&A process (Sharda et al., 2014). Furthermore, performance measurement systems can be completely assigned to the performance and strategy criteria in the BI&A environments (Lim et al., 2013; Sharda et al., 2014).

Recent publications reveal that studies about BI&A application in the construction industry have mainly focused on isolated parts of a construction process, rather than capturing the complete performance measurement of a construction company (Li et al., 2023; Singh et al., 2024). The majority of the studies have researched the role of BI&A systems in specific areas of construction activities, such as project management, cost management, budget preparation, quality control, or safety and risk management (Cheng et al., 2010; Ghazal & Hammad, 2022; Hammad et al., 2014; Lopes & Boscarioli, 2020; Shin, 2015).

As a result, only a few studies have researched the role of BI&A in supporting organizations' performance measurement systems (Lopes & Boscarioli, 2020). On the other hand, contributions from Varun et al. (2023), for instance, keep addressing the importance of data analytics in performance measurement systems in the construction industry. Furthermore, Singh et al. (2024) argue that, among other things, more research about big data analytics in improving performance evaluation systems could improve the widespread deployment of big data analytics in the building industry. Additionally, research by Zheng et al. (2016) concluded that research into performance measurement systems of construction enterprises lacks a translation between theoretical frameworks and practical software tools, raising concerns about the practical adaptation process of BI&A systems.

Figure 1: Challenges in BI&A and performance measurement in the construction industry

Performance measurement systems in the construction industry lack the adoption of non-financial performance indicators, addressing the need for the widespread adoption of more balanced, long-term focused performance measurement systems in the construction industry. Also, although both the industry and literature recognize the importance of BI&A systems and data in the construction industry, research addressing BI&A use in performance measurement systems remains scarce. In addition, there is a need for a more practical translation of performance measurement theory and its corresponding systems for adoption in practice. Therefore, there seems to be a gap in research on how Business Intelligence and Analytics systems can help in applying balanced performance measurement systems in construction companies.

Note. Own work

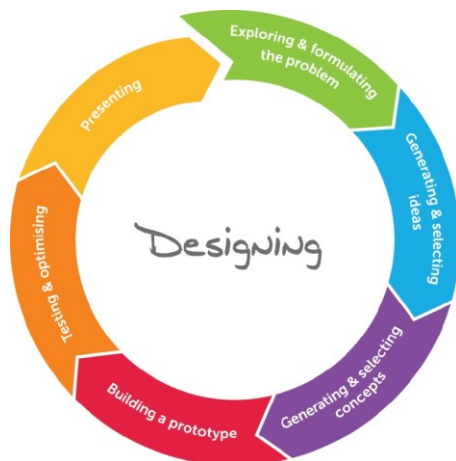
Research goal

The main goal of this study is to investigate how the Balanced Scorecard framework as a balanced performance measurement system can be applied to a company in the Dutch construction sector, while considering how a BI&A architecture with its corresponding elements can support in transforming raw data into valuable business information. The main research question, therefore, is:

How can a balanced performance measurement system be applied in a Dutch construction company using Business Intelligence and Analytics systems to enhance performance management?

To address this, a case study of a mid-sized Dutch construction company, follows a design research approach by Ulrich and Eppinger (2016). Design research is associated with the Design Thinking approach by Brown (2008), which often reveals itself as an iterative, step-wise design cycle, as presented in Figure 2.

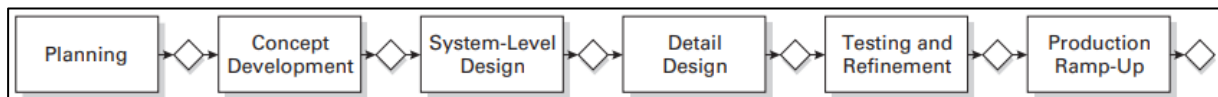
Figure 2: The Design Cycle



Note. Adapted from *Creativity in Design*. In (pp. 51-72) by Klapwijk, R, 2017

The design research project delivers a BI&A architecture specifically designed for the company's strategy and the Balanced Scorecard framework. To achieve this, an investigation of the desired and current situation regarding performance measurement systems and BI&A systems reveals business needs. Then, the business needs are prioritized and transformed into design specifications. Next, by applying Balanced Scorecard theories and BI&A frameworks to the current situation, a system-level Information and Communication Technology (ICT) design to solve the case, eventually developing into a prototype. An iterative process of testing, evaluating, and refining eventually reveals a final design as a deliverable to the company's Board of Directors. The applied design process is presented in Figure 3.

Figure 3: The Generic Product Design and Development Process



Note. Adapted from *Product design and development* by Ulrich, K. T., & Eppinger, S. D, 2016, (p. 22)

Five sub-questions have been developed representing the design research phases to answer the main research question. The design research follows Ulrich & Eppinger's research process as well as the Information Systems Research Framework by Hevner et al. (2004). As this research's goal and central question are already defined, the research starts with investigating the business needs. The sub-questions are focused on a deep-dive approach to the phenomenon, focusing on the practical translation of the Balanced Scorecard and BI&A theory. The sub-questions are the following:

1. *What are the criteria and requirements regarding the desired performance measurement of the case company?*

Investigating the criteria and requirements regarding the performance measurement system identifies business needs for the case company's desired situation. This question identifies the interpreted needs regarding the design of the performance measurement system, the strategic objectives, measures, targets, and initiatives for the balanced scorecard application.

2. *What are the characteristics of the current performance measurement system and BI&A architecture used within the case company and relevant literature?*

As the company's existing performance measurement system and BI&A architecture are evaluated, they present what performance measurement practices, analytical systems, data, and measuring tools are already accessible and present within the company, revealing the current situation. Also, an investigation of the literature reveals relevant indicators and metrics of performance measurements currently used in the construction industry for a complete view.

3. *What are the design specifications of the case company's desired performance measurement?*

By comparing and combining the desired and current situation from sub-questions 1 and 2, interpreted needs coming from both situations are integrated. These so-called 'business needs' are organized, prioritized, and transformed into target specifications as input for the solution concepts (Hevner et al., 2004; Ulrich & Eppinger, 2016).

4. *Which concept Balanced Scorecard design and BI&A architecture for the case company best translates the target specifications?*

Concept designs are generated by triangulating target specifications, BI&A architecture frameworks, and Balanced Scorecard theories to develop a Balanced Scorecard system for the company. The best concept design is presented in the results as a prototype system.

5. *What adjustments are needed to align the designed system to the case company's final specifications?*

The last step, a process of evaluating, feedback, and refining, finally reveals a valid end product (Hevner et al., 2004; Simon, 1969). By aligning with the company's final specifications (e.g., criteria and requirements), the final system is a solution to close the identified gaps in the company's desired situation. The final product will be presented to the Board of Directors of the company. Moreover, the final design answers the main research question. The five sub-questions outline the key phases of the design research process and will not be answered in the conclusion separately. Table 1 summarizes the research process and approach.

Table 1: Sub-question approach

Sub-question	Method	Who / What sources	Answer / deliverable
1	<ul style="list-style-type: none"> - Semi-structured interviews - Document analysis - System observation 	<ul style="list-style-type: none"> - Directors, Subsidiary managers, supporting staff managers - Strategy & BI&A documents - Intelligence & analytics systems 	<ul style="list-style-type: none"> - Business needs for performance measurement design - Business needs for balanced scorecard application
2	<ul style="list-style-type: none"> - Semi-structured interviews - Document analysis - Literature review - System observation 	<ul style="list-style-type: none"> - Directors, Subsidiary managers, supporting staff managers - Strategy & BI&A documents - Relevant construction performance measurement literature - Intelligence & analytics systems 	<ul style="list-style-type: none"> - Current performance measurement system - Relevant performance indicators - Current BI&A systems and architecture
3	<ul style="list-style-type: none"> - Interpreting business needs - Interpreting current characteristics - Multivoting workshop 	<ul style="list-style-type: none"> - Q1 business needs - Q2 current characteristics - Selection lead users 	<ul style="list-style-type: none"> - Performance measurement target specifications - Balanced Scorecard Target specifications
4	<ul style="list-style-type: none"> - Concept design - Prototype design 	<ul style="list-style-type: none"> - Target specifications - BI&A architecture frameworks - Balanced Scorecard literature 	<ul style="list-style-type: none"> - Prototype Balanced Scorecard design - Prototype BI&A architecture design
5	<ul style="list-style-type: none"> - Final specification workshop - Final design adjustments 	<ul style="list-style-type: none"> - Prototype Balanced Scorecard - Prototype BI&A architecture - Final specifications 	<ul style="list-style-type: none"> - Final specifications - Final design

Note. Own work

Theoretical contribution

This study examines how today's BI&A systems can enhance performance measurement systems' application by practically integrating two theoretical frameworks. Current BI&A research in the construction industry mainly focuses on specific business functions and project evaluations rather than complete organizational performances. Also, performance measurement research in the construction industry lacks the integration of data-driven approaches. Only a few studies integrate BI&A and performance measurement systems in the building industry. Results, therefore, contribute to the theoretical understanding and fill the gaps of BI&A integration in performance measurement as an unexplored part of research in the construction industry.

Next, the design research contributes to performance measurement system theory by using and applying a state-of-the-art balanced performance measurement system to a specific case. The design project assesses the practical challenges and solutions for application in the context of a company in the construction industry, characterized as a financially driven, short-term-oriented industry. Applying a balanced, long-term-focused performance measurement system to an industry that lags behind in adopting non-financial performance indicators can provide valuable insights. Specific adjustments, tradeoffs, and extensions can be adapted, although one case does not provide generalizable evidence.

Also, Balanced Scorecard alternatives and application theories are applied in practice, revealing functional insights, drawbacks, and benefits of these theories, while also incorporating identified limitations from relevant literature. These insights further expand application theories, providing practical evidence.

Furthermore, this research reviews the current state of practical BI&A systems in a mid-sized construction company, revealing insights that, together with other case studies, contribute to the general development of BI&A system adoption in the construction industry. This supports the progression of data processing technologies in the construction industry, which struggles to catch up with other industries.

The case study also adds knowledge to literature, which lacks a practical translation of performance measurement theory. By applying a performance measurement system to a specific setting and context,

new insights present how a strategy transforms into specific operational tools with objectives and performance indicators. As current literature lacks a practical translation of performance measurement theory and its corresponding systems, this case study addresses those practical challenges and characteristics.

These contributions to theory could enhance the widespread deployment of data analytics and intelligence in the building industry, specifically in performance measurement systems.

Finally, the design research process and its corresponding research methods add to the body of design research methodologies. For instance, developing evaluation methods to measure how well a prototype design performs contributes to evaluation method theories (Hevner et al., 2004).

Practical contribution

From a practical point of view, this research delivers a practical final product to the company. The research aims to deliver an implementable system for the use of a balanced performance measurement system that is evaluated and partially designed through target and final specifications. This design ‘artifact’ is the solution to the identified problems, presenting a transparent design process based on real-life evidence.

Furthermore, this research presents how the Balanced Scorecard framework is applied in a construction company. Thus, an example of how strategy transforms into measurable objectives and goals can provide a useful understanding for other construction companies.

The research reveals a transparent step-by-step replicable design method for integrating the Balanced Scorecard and BI&A systems. Construction companies and managers can gain insights into how the design process progressed, enabling others to replicate this process and apply the same design process to other settings and contexts. Therefore, facilitating scalability and the general development of enhanced performance measurement systems in the construction industry.

Outline of thesis

Chapter 2 describes and interprets the key theories and literature regarding the research topics. Next, Chapter 3 presents the methodology of this research in detail. The results and main findings of the research phases are presented in Chapter 4. Chapter 5 discusses these findings and results by interpreting and comparing them to existing literature, theories, and cases. The chapter also discusses the theoretical and practical implications, limitations, and recommendations for future research directions. In Chapter 6, the research is concluded by presenting the key findings.

2 Theory

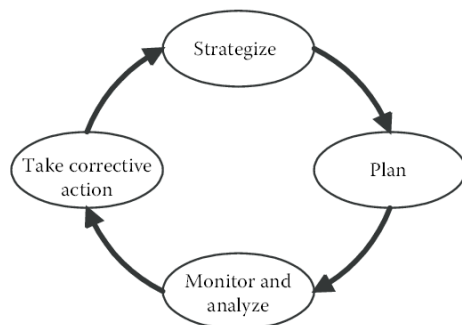
The theory section describes the key concepts and relevant literature related to the central research question. First, the theory focuses on performance measurement systems, the Balanced Scorecard, alternative balanced performance measurement systems, and specific application theories. Then the key theories and literature of Business Intelligence and Analytics are discussed, after which the key theoretical concepts are merged to synthesize them.

2.1 Performance measurement systems

A performance measurement system is a collective name for frameworks and models designed to measure organizational performance (Nudurupati et al., 2007). Although there is no agreed definition of a performance measurement system in literature, most descriptions are mentioned in the context of strategic and operational measurement of organizational performances (Pinheiro de Lima et al., 2013). Bititci et al. (2000), one of the most cited authors, describe a performance measurement system as a general tool that supports decision-making and management control. Performance measurement systems are designed for internal control and also function as external reporting tools for stakeholders of organizations (Cagno et al., 2023; Maestrini et al., 2017; Vegter et al., 2023).

Performance measurement systems ensure that analytical processes and objective measures are linked to the strategy of organizations (Bassioni et al., 2004; Sharda et al., 2014). Thus, these systems fall under the business performance management (BPM) tree, shown in Figure 4. Their main objective is to support managers in monitoring how their organization's strategy performs by comparing measured results with predefined objectives and targets derived from the strategy (Simons et al., 2000). Performance measurement systems are, therefore, often implemented in companies' business performance management processes (Franco-Santos et al., 2007; Frolick & Ariyachandra, 2006).

Figure 4: The BPMN Framework



Note. Reprinted from *Business Performance Management: One Truth* by M. N. Frolick and T. R. Ariyachandra, 2006, *Information Systems Management* 23, (p. 43)

As a result, using a performance measurement system requires organizations to design performance objectives based on their strategy (Bassioni et al., 2004; Pinheiro de Lima et al., 2013). Additionally, performance metrics and calculations need to be developed to measure how well an organization performs on the selected objectives. Based on the calculated level or score on each objective, organizations can prioritize necessary actions to improve on those objectives (Frolick & Ariyachandra, 2006; Vegter et al., 2023). Performance measurement systems usually include a structured approach for the design process of setting objectives. In addition, a time perspective is commonly used in performance measurement systems, providing regular reports to track progress on objectives over time (Sharda et al., 2014; Simons et al., 2000).

Performance measurement systems were introduced to organizations in the 1980s, as the focus of organizational performance was primarily aimed at looking back at financial performance. The main advantage at that time was that performance measurement systems had relevant, dynamic, and balanced measurement indicators aligned with the strategy (Giannopoulos et al., 2013; Pinheiro de Lima et al., 2013; Zheng et al., 2016). A well-aligned performance measurement system gives insights to improve the performance of organizations (Neely et al., 2005; Nudurupati et al., 2007). Therefore, the rise of performance measurement systems can be seen as a reaction to the traditional accounting and financial perspective from the 1960s and 1970s (Kaplan & Norton, 1996; Zheng et al., 2016).

As interest in performance measurement systems grew among industries, new and more diverse systems also evolved in literature in the 1980s (Bourne et al., 2005). Keegan et al. (1989) were among the first researchers whose Performance Measurement Matrix is often cited in performance measurement system literature (Neely et al., 2007). At that time, the Performance Pyramid by Cross and Lynch (1988), Performance Prism by Neely et al. (2002), and the Balanced Scorecard by Kaplan and Norton (1992) also evolved into successful performance measurement systems.

From the 2000s, several reports and studies suggested the Balanced Scorecard as one of the most widely used performance measurement systems across industries (Bassioni et al., 2004; Rigby, 2013; Zheng et al., 2016). The Balanced Scorecard was particularly popular across industries because of its universal adaptability, structured conceptual framework, clear strategy translation, usability, and communicability among stakeholders (Tawse & Tabesh, 2023).

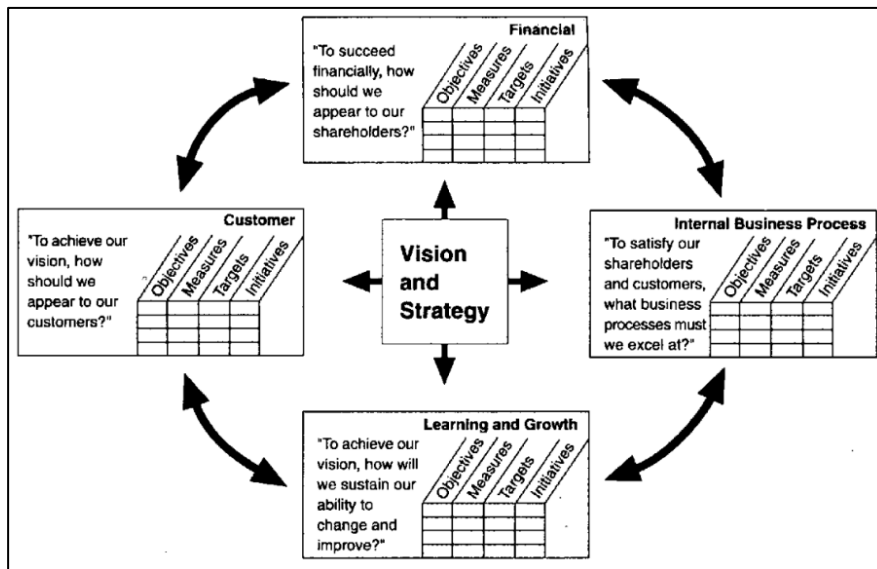
The use of the Balanced Scorecard hit its maximum around 2009, after which the use of the so-called BSC dropped in the 2010s (Kumar et al., 2024; Rigby & Bilodeau, 2009). In the 2020s, the BSC gained popularity again. Nowadays, several studies claim that around 50-90% of all businesses have ever used the Balanced Scorecard as a performance measurement system (2GC, 2021; Kumar et al., 2024; Sharda et al., 2014). The ongoing popularity of the Balanced Scorecard caused the development of many BSC-related or derived performance measurement systems from the 2010s onwards (Zheng et al., 2016). Specific Balanced Scorecard research into the construction industry measured that in the U.K., only 13% of the companies used the Balanced Scorecard as a performance measurement system (Bassioni et al., 2004; Robinson et al., 2005).

2.1.1 Balanced Scorecard

After the widespread adoption of performance measurement systems in the 1990s, discussions in business fields and academic literature arose about whether operational or financial measures were the most relevant in assessing and evaluating the performance of a business (Kaplan & Norton, 1992). This discussion also involved debates about the risks of relying on one aspect of a business, but that having too many measures to rely on could cause an information overload. Such an overload would make an organization's internal and external performance assessments too complex (Kaplan & Norton, 1996).

In the search for a set of measures that was easily and quickly accessible, but also broad enough to capture the overall performance of a business, Kaplan and Norton (1992) developed the Balanced Scorecard, or BSC. Kaplan and Norton (1992) proposed the BSC as a performance measurement system that evaluates organizations from four key perspectives. The BSC is known for developing strategic objectives, metrics, and targets related to the four perspectives, connecting business strategies to objectives and measures that can be compared to assess their performance (Tawse & Tabesh, 2023). Figure 5 shows the tabular layout of the Balanced Scorecard.

Figure 5: The Balanced Scorecard Framework, Translating Strategy into Operational terms



Note. Reprinted from *Using the Balanced Scorecard as a Strategic Management System* by Robert S. Kaplan and David P. Norton, 1996, *Harvard Business Review*, (p. 76)

The four perspectives—customer, financial, learning and growth, and internal business processes—all contribute equally to the performance of an organization. The scorecard was particularly named 'balanced' as it reflected a balance between financial and non-financial measures, short- and long-term perspectives, external and internal performances, and lagging and leading indicators (Kaplan & Norton, 1996). In their first BSC publication, Kaplan and Norton (1992) introduce example measures for each of the four perspectives to point out that the performance measurement system can be used in different industries (Tawse & Tabesh, 2023). The balanced scorecard should be tailored to organizations' developed strategy, mission, vision, and objectives regarding the four perspectives. As a result, the Balanced Scorecard focuses on overseeing the strategy execution and not creating a strategy (Lawrie & Cobbold, 2004).

First, the customer perspective focuses on internal efforts and external outputs of customers and markets (Kaplan & Norton, 1996). It identifies customer satisfaction and retention as important and leading indicators of future business success (Sharda et al., 2014). Kaplan and Norton (1992) argue that companies should develop goals and measures for time, quality, performance and service, and cost of their product or service.

Next, the financial perspective ensures that financial growth, profitability, and cash generation trends are tracked, as they remain critical insights for shareholders. The financial perspective focuses on expanding the business, sustaining current financial performances, and producing maximum results for the company (Kaplan & Norton, 1996). Market share, revenue, return on equity (ROE), return on investment (ROI), operating income, quarterly sales growth, and cash flow are proposed as examples of financial goals (Arnaboldi et al., 2014; Kaplan & Norton, 1992).

Moreover, the innovation and learning perspective aims to ensure competitiveness by focusing on the ability to improve and create value through employee development, knowledge sharing, and a learning culture in the organization (Sharda et al., 2014). Kaplan and Norton (1992) suggested the development time of new products, product introduction to market time, and/or process times as measures of learning phenomena. Kaplan and Norton later renamed this perspective into the learning and growth perspective (Kaplan & Norton, 1996; Lawrie & Cobbold, 2004).

At last, the internal business process perspective focuses on the internal processes of organizations, emphasizing efficiency, critical capabilities, and quality products and services as outcomes of this process (Kaplan & Norton, 1992). The perspective captures performances on essential business processes (Kaplan & Norton, 1996). Measures like productivity should be divided into time, quality, product, and cost levels (Kaplan & Norton, 1992).

The Balanced Scorecard is designed in a way that each business can add its own objectives to the scorecard based on its specific strategy, vision, and mission. Typically, the senior management is responsible for translating the strategy into objectives and setting measurements based on their strategic expertise and experience (Kaplan & Norton, 1996). The term 'scorecard' refers to the single-screen view of all the perspectives, consisting of objectives, measures, targets, and actions/initiatives. Kaplan and Norton (1996) recommend using between 20 and 25 objectives in the scorecard (Lawrie & Cobbold, 2004). This single-screen view of organizational performance aligns with the strategic orientation of performance measurement systems (Sharda et al., 2014). This single-screen view typically consists of tables mapping the objectives and corresponding metrics, measurements, and targets (Lawrie & Cobbold, 2004).

Furthermore, as different perspectives influence each other, results in one objective could influence a positive result in another objective. The interrelationships between these perspectives indicate a cause-and-effect relationship in leading and lagging perspectives (Lawrie & Cobbold, 2004).

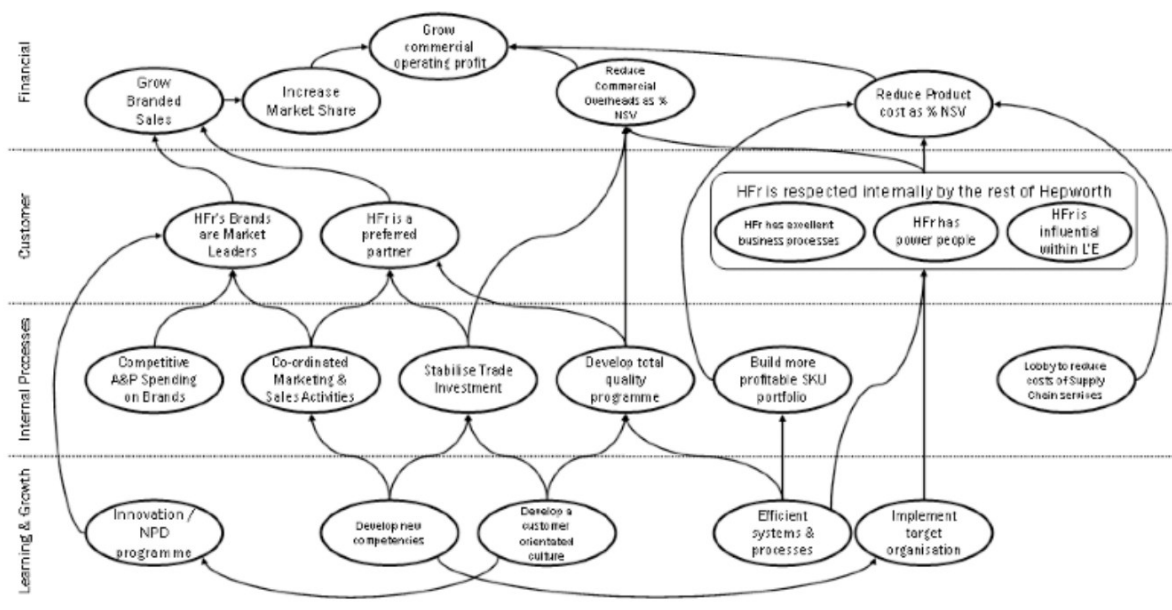
The Balanced Scorecard, therefore, balances out several aspects of performance measurement systems by proposing a single screen view of four interrelated perspectives measuring organizational performance.

2.1.2 Alternative balanced performance measurement systems

From the 2000s onwards, the Balanced Scorecard gained popularity as the typical tabular design representing the four perspectives, also referred to as the first-generation Balanced Scorecard (Lawrie & Cobbold, 2004). The Balanced Scorecard evolved as a common concept among several industries (Tawse & Tabesh, 2023; Zheng et al., 2016). This popularity resulted in the critical balanced and integrated characteristics becoming vague and explanations of the Balanced Scorecard being interpreted wrongly (Sharda et al., 2014). Thus, critics of the designability of the first-generation Balanced Scorecard started an academic wave of Balanced Scorecard variants. These variants adjusted the applicability of the four perspectives, as it was argued that they were less suited to non-profit, public, or specialized organizations (Lawrie & Cobbold, 2004). It was argued that the selection and design processes of indicators in perspectives were not properly described by Kaplan and Norton in 1992 (Elbanna et al., 2022; Kaplan & Norton, 1996; Lawrie & Cobbold, 2004). Furthermore, other single-screen strategic decision-making tools gained popularity as a counterpart of the Balanced Scorecard (Epstein & Manzoni, 1997).

Consequently, developments in the second-generation Balanced Scorecards focused on the causality of the four perspectives and on measure selection for each perspective. Strategic objectives, directly coming from the company's strategy, should be incorporated in the scorecard, as they provide the rationale for selecting specific measures over alternative measures. Finally, a newly developed strategy map emerged. The strategy map visually links roughly 20 strategic objectives, across the four perspectives (Kaplan, 2004; Lawrie & Cobbold, 2004; Neely et al., 2007). Strategy maps increase the justification for the selection process and design of the Balanced Scorecard, as the visual cause-effect links replicate the strategy (Olve et al., 2001). This strategy map, also called the strategic linkage model, graphically presents causality, showing how performances on one objective affect performances in other perspectives (Kaplan & Norton, 1996, 2008; Lawrie & Cobbold, 2004). Figure 6 shows an example of a strategic linkage model.

Figure 6: Strategic Linkage Model



Note. Reprinted from *Development of the 3rd Generation Balanced Scorecard: Evolution of the Balanced Scorecard into an effective strategic performance management tool* by Gavin Lawrie and Ian Cobbold, 2002, (p. 7)

The third and current generation of scorecards is known as a clarifying generation of scorecards. The main innovation is the addition of better quantifiable objectives and the introduction of clear time goals (e.g., measurable end point within five years), called 'Destination statements' (Hoque, 2014; Kaplan & Norton, 2008; Lawrie & Cobbold, 2004). Thus, the design of destination statements defines the approximated or predicted state of businesses at a specific future time point. An example set of destination statements is displayed in Figure 7. As a result, a separate document containing these destination statements represents the strategy, selected targets, measures, and initiatives taken to achieve these destination statements.

Figure 7: Destination Statements

<p>Stakeholder Expectations and Financial Resources</p> <ul style="list-style-type: none"> • S&F1 - SPG has grown its total income (external and internal) to £300M (NIL NIL) • S&F2 - 70% of SPG income comes from direct and indirect Government funding (£210M - £235M now) * (NIL NIL) • S&F3 - 30% of SPG income is derived from commercial revenue of which £30M is non-explosive related and £60M is explosive related (£90M-£16M now) * (FIVE SEVEN) • S&F4 - SPG has achieved a level of profit on total revenue that is at least x% * (TWO NIL) • S&F5 - SPG has created a capital investment plan to ensure it can achieve its growth & profit targets (NIL NIL) • S&F6 - SPG has met its return on capital employed (ROCE) targets of x% * (ONE NIL) 	<p>External Relationships</p> <ul style="list-style-type: none"> • ER1 - SPG has benefited from its benchmarking relationships with the DDC, Trading Funds, government agencies and other organisations in that business improvement can be linked directly to these alliances/ liaisons (NIL NIL) • ER2 - SPG has identified its key markets and is the first choice provider within them (NIL NIL) • ER3 - Customers / consumers use SPG because they perceive we meet their needs (ONE NIL) • ER4 - SPG meets customer / consumer needs as promised (NIL NIL) • ER5 - SPG has win / win fixed relationships with key suppliers (FOUR SEVEN)
<p>Organisation and Culture</p> <ul style="list-style-type: none"> • O&C1 - We have outsourced non-core activities appropriately (FOUR THREE) • O&C2 - SPG has aligned and delegated authority and responsibility across the organisation to the lowest appropriate level (ONE NIL) • O&C3 - SPG has developed a training philosophy that is embraced by staff and generates both functional and professional qualifications in support of business (NIL NIL) • O&C4 - SPG has an employment policy and package that attracts and retains the right quality staff (NIL NIL) • O&C5 - SPG has a flat management structure with no more than 4 layers (team, function/shed, site/function, HO/function) and no more than 5 basic grades (worker, team leader, Junior, middle, and senior manager) (NINE SIX) • O&C6 - SPG has achieved a balanced & structured workforce with a ratio of direct to indirect manpower that compares favourably with national commercial standards (ONE TWO) 	<p>Processes and Capabilities</p> <ul style="list-style-type: none"> • P&C1 - SPG has a single integrated management and planning system that meets all of the needs of the business and exploits the latest technology (THREE FOUR) • P&C2 - SPG has access to coherent business information across the organisation that can be measured and used to cost accurately existing activity and new work. This allows the business to charge appropriate rates according to the level of activity (FOUR THREE) • P&C3 - SPG has a benchmarking strategy to conduct continuous internal and external benchmarking of peers and the monitoring of competitors in order to deliver continuous improvement and the achievement of its objectives (NIL NIL) • P&C7 - SPG has a tracking capability that identifies stock condition and location continuously from receipt through to the consumer as part of an integrated supply chain (EIGHT EIGHT) • P&C8 - SPG is responsible for all defence distribution across the entire supply chain from industry to the operational consumers (THREE SIX) • P&C9 - All commodities are stored and secured in the most appropriate storage environment including CHE (NIL NIL)

Note. Reprinted from *Development of the 3rd Generation Balanced Scorecard: Evolution of the Balanced Scorecard into an effective strategic performance management tool* by Gavin Lawrie and Ian Cobbold, 2002, (p. 7)

Currently, the strategy map, Balanced Scorecard, and the destination statements together represent the third-generation Balanced Scorecard, effectively consisting of three interrelated elements (Lawrie & Cobbold, 2004).

In addition to the base generations, deviations from the BSC, such as the Dynamic multi-dimensional performance framework of Maltz et al. (2003), the Total Quality Management-BSC by Hoque (2003), and the BSC for supply chain management by Bhagwat and Sharma (2007), also gained interest in performance measurement literature in the 2000s. These deviations applied the Balanced Scorecard in specific performance measurement approaches such as manufacturing or supply chain management.

Other deviations from the BSC did not focus on applying the BSC for different industries or business functions but rather on the balance in perspectives. In a case study, Butler et al. (1997) proposed three perspectives instead of Kaplan and Norton's four perspectives, focusing on the shareholders (financial), extraordinary growth, and continuous improvement. Butler et al. (1997) argue that their developed scorecard with the three perspectives better integrated the mission of the studied company. In their view, the generic Balanced Scorecard from Kaplan and Norton did not align with the identity, culture, and purpose of the studied case (Butler et al., 1997).

These adjustments and alternative deviations from the basic first-generation Balanced Scorecard offer possibilities as flexible, adjustable, and industry-specific Balanced Scorecards, improving the concept's applicability to industries and organizations in practice.

In the end, the BSC remains a general concept, and it only becomes a clear performance measurement system when an organization applies its strategy, goals, and objectives to it. Although available case studies argue the (dis)advantages of the Balanced Scorecard for organizations, its value will remain uncertain and can only be evaluated through practical application (Ahn, 2001; Mooraj et al., 1999).

2.1.3 Balanced Scorecard application

Although the successful practical application of the Balanced Scorecard cannot be guaranteed based on academic case studies, a focus on the application methods of these studies shows insightful elements that support application success.

As one of the most cited Balanced Scorecard authors, Lawrie and Cobbold (2004), also focus analysis on the design process in their analysis of the three generations of scorecards. Therefore, the analysis of the generation process of the Balanced scorecard is based on the third and latest generation of scorecards. The generation of the Balanced Scorecard should be the responsibility of the senior management because of their unique access to strategic insights and their role in defining, justifying, and promoting the strategy throughout the organization (Kaplan & Norton, 1996).

By starting with mapping the company's strategy through a strategic linkage model by the senior management, the cause-effect relationships of activities and outcomes are mapped. Lawrie and Cobbold (2004) mention dividing the strategy map into an 'activity' and an 'outcome' category, rather than the four Balanced Scorecard perspectives specifically for public organizations, combining 'financial' and 'customer' perspectives as outcome perspectives as public organizations are not specifically financially oriented. Within the strategy map, brief statements or short titles clarify strategic objectives to make the strategic linkage model more clear (Lawrie & Cobbold, 2004).

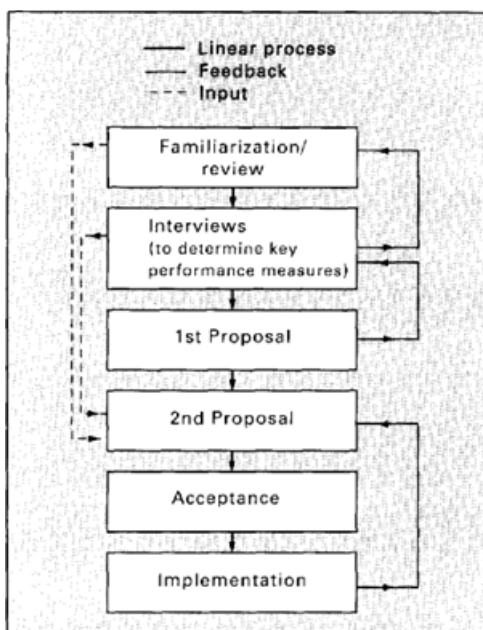
Next, developing destination statements for each strategic objective in the strategic linkage model ensures that the prioritized strategic objectives have linked targets with a future date. The destination statement acts as a supporting reference for the target setting, enhancing the strategy translation to the Balanced Scorecard and enabling quicker agreement between senior management (Lawrie & Cobbold, 2004).

Through the strategic linkage model and the destination statements, the generation of the scorecard itself is simplified as metrics and targets are clear, and scores can be reported based on the development of clear measurements and calculations (Lawrie & Cobbold, 2004). The Balanced Scorecard itself should present both drivers and outcome metrics within perspectives, displaying the interrelated character of the objectives. Despite the logical design order, Lawrie and Cobbold (2004) later propose starting with designing the destination statements before mapping the strategy visually, ensuring an easier objective and link process.

Within the generation process, Butler et al. (1997) argue that the focus is on first defining objectives for the individual perspectives before mapping the objectives and links in the strategy map (Ahn, 2001). Ahn (2001) specifically identified controllability, decomposability, non-redundancy, and completeness of indicators as the main factors influencing the successful implementation of the Balanced Scorecard. With controllability, Ahn (2001) means the influenceability of indicators, the extent to which the measures of performances are influenceable. Decomposability focuses on breaking down objectives into smaller measurable elements (Ahn, 2001). This emphasizes that generating a Balanced Scorecard is not just converting strategy into targets but also determining metrics and measurement criteria for those targets. The non-redundancy factor justifies this as metrics focus on separate objectives without overlapping or measuring the same thing. On the other hand, Ahn (2001) argues that completeness remains important in a way that the total set of performance measurements covers the main strategic objectives without overseeing or neglecting crucial indicators.

On a higher level of the generation process, Butler et al. (1997) applied the Balanced Scorecard to a divisional organization. They used a double-validation process for the generation of the Balanced Scorecard. The process used interviews to determine the key performance measures and validated the scorecard proposals twice before delivering a final accepted design. This method, including feedback processes, emphasizes linking the strategy to indicators as a crucial process, as shown in Figure 8.

Figure 8: Balanced Scorecard generation process



Note. Reprinted from *Linking the Balanced Scorecard to Strategy* by Alan Butler, Steve R. Letza, and Bill Neale, 1997, *Long range planning* 30, (p. 246)

Also, Lipe and Salterio (2000) researched the influence of specific indicators in the Balanced Scorecard of an organization consisting of multiple divisions or business units. By applying 'common' objectives for all business units, covering the overall strategy of the organization, and 'unique' objectives that only apply to specific business units (Lipe & Salterio, 2000). Despite this theoretical

contribution, the researchers found that unique objectives were overlooked by business unit managers, highlighting the need for decision-making and strategic experts in the design process of the Balanced Scorecard (Ahn, 2001; Lipe & Salterio, 2000).

Findings from implementations of the Balanced Scorecard in SMEs highlight the limited availability of fixed strategic documents, vision documents, or any established strategy at all, representing SMEs' highly responsive and agile nature (Andersen et al., 2001; Rompho, 2011). As a result, application findings describe capturing the—mostly short-term oriented—strategic vision and objectives through strategy documents and by using and convincing the most important managers as strategic experts (Andersen et al., 2001; Hvolby & Thorstenson, 2000). The findings describe the differences between theory and practice applying the Balanced Scorecard as a tool for translating strategic objectives.

Looking at the construction industry, Koprivica et al. (2021) recently researched the implementation of the Balanced Scorecard, arguing the lack of strategic vision, focus on short-term profits, and neglecting long-term impact creation. Koprivica et al. (2021) conclude that the Balanced Scorecard could still represent the financial priorities of companies while also innovation and value creation performances are being monitored simultaneously. Dobrovič et al. (2018) argue that the use of the Balanced Scorecard in the construction industry does not only provide future benefits to shareholders, but also to stakeholders such as employees, clients, and suppliers. Dobrovič et al. (2018) concluded that using the Balanced Scorecard improved the importance of non-financial and long-term insights within companies. Lastly, Torgautov et al. (2022) used a strategy map first. Then, they sent out a survey in which strategic experts of construction companies were asked to rate measures for the strategic objectives from the four Balanced Scorecard perspectives. This method resulted in a list of key metrics used in the construction industry based on the four Balanced Scorecard perspectives (Torgautov et al., 2022). Other researchers such as Barros et al. (2020), Horta et al. (2010), and Chan and Chan (2004) also researched, identified, or prioritized key indicators in the construction industry.

These application theories represent the multiple contradictions and trade-offs of the application process of generating a Balanced Scorecard for different organizational types, sizes, structures, industries, and organizations in general.

2.1.4 Balanced Scorecard critics

Nowadays, the concept of the Balanced Scorecard has been around as one of the most impactful and recognized performance measurement systems for over 30 years, following the first publication of Kaplan and Norton in 1992 (Tawse & Tabesh, 2023). The current third-generation Balanced Scorecard, proposed by Lawrie and Cobbold (2004), counters criticisms of practical transferability and causality, as well as the absence of quantifiable goals with a time dimension. Nevertheless, after three generations of the Balanced Scorecard, the concept receives academic criticism for its design and applicability.

The long-standing popularity of the Balanced Scorecard across several industries resulted in extensive academic and professional literature streams. The popularity of the Balanced Scorecard does not guarantee that it is a comprehensive or complete performance measurement system. Consequently, literature streams also indicate critical reflections and discussions of the limitations of the theoretical foundations and assumptions of the original Balanced Scorecard. A review of six relevant Balanced Scorecard criticisms reveals several reoccurring limitations and weaknesses. The following selection of reviews is used:

Table 2: Selection of critical Balanced Scorecard reviews

Reference	Title	Review type	Focus
(Aryani & Setiawan, 2020)	Balanced Scorecard: Is it beneficial enough?	Literature review	Balanced Scorecard critics in private and public sectors
(Awadallah & Allam, 2015)	A Critique of the Balanced Scorecard as a Performance Measurement Tool	Critical Review	Balanced Scorecard as Performance Measurement Tool
(Hoque, 2014)	20 years of studies on the balanced scorecard: Trends, accomplishments, gaps, and opportunities for future research	Literature review	20-year review synthesizing findings.
(Kumar et al., 2024)	Balanced scorecard: trends, developments, and future directions	Literature review	30-year evolution and future of Balanced Scorecard
(Norreklit, 2000)	The balance on the Balanced Scorecard a critical analysis of some of its assumptions	Critical review	Assessing Balanced Scorecard assumptions
(Tawse & Tabesh, 2023)	Thirty years with the balanced scorecard: What we have learned	Qualitative and quantitative evidence analysis	30-year review synthesizing findings

Note. Own work

The original Balanced Scorecard raises concerns regarding its applicability in non-profit, public, and specialized organizations. The design of the Balanced Scorecard, with its corresponding strategic linkage model, confirms the interrelationships and causality between objectives among perspectives, which eventually should positively influence performance from a financial perspective. However, this focus assumes that every organizations' core driver is financial performance, whereas public or non-profit organizations' core values lie in providing social impact or public services (Kennerley & Neely, 2002; Norreklit, 2000). This limits the applicability of the Balanced Scorecard in these industries.

This disadvantage is further criticized by Awadallah and Allam (2015). They mention the focused orientation of the Balanced Scorecard to shareholders, causing limited attention to alternative crucial stakeholders such as the environment, public organizations, or stakeholders in the value chain (Awadallah & Allam, 2015). For instance, external innovation objectives are hardly adopted as the internal orientation of the Balanced Scorecard does not provide cause-effect linkages with partners or collaborating organizations. The internal orientation produces risks for organizations, as the limited view could miss external opportunities and chances, limiting organizations' growth potential.

Especially a renewed view on the social, human resource perspective focusing on collaboration and the social dimension found in public organizations, gained popularity (Kong, 2010; Moullin, 2017). For example, Brignall (2002), in his paper 'The Unbalanced Scorecard,' argues the inclusion of social and environmental measures into the BSC as particularly valuable, as not only employees, shareholders, and customers are stakeholders of organizations, but also the community and environment should be a stakeholder of the organization. These propositions are often combined in literature as the so-called Sustainability Balanced Scorecard, or SBSC (Aryani & Setiawan, 2020).

Recent publications focus on adjusting the Balanced Scorecard to sustainability practices, for example, by applying measures of corporate social responsibility (CSR), circular economy, or environmental education (Chehimi & Naro, 2024; Mio et al., 2022; Torgautov et al., 2022). Although Kaplan and Norton (1996), mention the possibility to use extra perspectives in the Balanced Scorecard, they do not specifically mention any 'social' or 'environmental' perspective to be included to provide balance in stakeholders' interests (Hansen & Schaltegger, 2016).

The main criticisms of the generation and application process of the Balanced Scorecard centers around which actors participate in the design process. Kaplan and Norton, in 1996, claimed the generation of the Balanced Scorecard as main responsibility of all senior executives, based on their strategic role, expertise, and experience. Although Tawse and Tabesh (2023) approve the importance of the top management team (TMT) in the generation process, they mention that this method lacks the widespread involvement of other stakeholders of the organizations. A lack of participation and communication of the Balanced Scorecard application among employees and other important stakeholders negatively affects strategy understanding, engagement, commitment and coordination in the generation process (Tawse & Tabesh, 2023). This can hinder the successful implementation of the Balanced Scorecard in practice.

Hoque (2014) mentions the lack of applicability of the general Balanced Scorecard, noting that the original Balanced Scorecard lacks explanations how to translate objectives into specific metrics and targets that define success on objectives. As a result, although companies are able to successfully translate strategy into strategic goals and objectives within the perspectives, generating or selecting the right metric or indicator to measure its success is often overlooked. Consequently, successful Balanced Scorecard implementations are often hindered as no applicable metric and indicator can be selected.

Also, Norreklit (2000) mentions that the Balanced Scorecard incorrectly assumes causality between objectives, whereas the relations between objectives are, in fact, logical relationships. As example, Norreklit (2000) mentions that a positive performance on an objective from the customer perspective does not directly cause better financial performances when the costs of the actions are not taken into account. Eventually, good financial performance is a logical result of low-cost actions that lead to better performance from the customer perspective. Therefore, the focus should be on displaying coherence and logical relationships among objectives rather than assuming causality between objectives (Norreklit, 2000).

More recent reflections criticize the flexibility of the Balanced Scorecard. The static layout of the Balanced Scorecard, with predetermined objectives and targets for a certain period, is not designed for rapidly changing environments requiring dynamic reports for fast-changing strategies (Aryani & Setiawan, 2020). Aryani and Setiawan (2020) further question the future applicability of the Balanced Scorecard as developments in the world of data and the internet result in new business models requiring agile evaluation methods to measure novel ways to create value. This increasing need for resilience for DVUCA environments (Disruptive, Volatile, Uncertain, Complex, and Ambiguous) is further justified by the recent COVID-19 experiences (Kumar et al., 2024).

Lastly, Kumar et al. (2024) mentioned the need for research into the role of artificial intelligence (AI) in automating Balanced Scorecard reports. An increase in research on how Industry 4.0 and Analytics 4.0 could contribute to performance measurement systems could improve future relevancy and adaptability of the Balanced Scorecard for highly dynamic industries and environments (Kumar et al., 2024).

These limitations and disadvantages in the Balanced Scorecard require a careful approach, as design considerations should be made in accordance with the requirements and needs of organizations.

2.2 Business Intelligence and Analytics

Business Intelligence and Analytics (BI&A) is widely used among industries as an umbrella term for concepts and methods for data-driven decision-making in industries. Therefore, BI&A is part of the information technology family, also called IT. The concept of BI&A historically evolved as a composition of the two terms: Business Intelligence (BI) and Business Analytics (BA).

Literature mainly refers to Dresner (1989) as one of the first researchers to use the term Business Intelligence, indicating the start of the evolution of Business Intelligence in literature in the late 1980s (Chen et al., 2012; Elena, 2011; Negash & Gray, 2008). In his research at Gartner, an influential American technology consultancy company, Dresner (1989) described Business Intelligence as “concepts and methods to improve business decision-making by using fact-based support systems” (Power, 2007, p. 3).

In the 1990s, Business Intelligence also became a well-known term in the information technology and business fields. Business Intelligence was known for processing collected data into business information through reports or visualizations (Chen et al., 2012; Power, 2007). As a result, Business Intelligence focused specifically on describing historical data, the so-called descriptive analysis. By monitoring how a situation “is” or “was,” decision-making is based on knowledge and understanding of the reports or visualizations (Negash & Gray, 2008).

The term Business Analytics evolved from Business Intelligence and focused specifically on the analytical part of intelligence. Especially in the 2000s, analytics became a popular term for Business Intelligence software (Delen & Zolbanin, 2018; Mortenson et al., 2015). In a paper reviewing analytical competitors, Davenport (2006) specified Business Analytics as “the ability to collect, analyze, and act on data” following the rapid development of big data and techniques for processing big data (Chen et al., 2012). As a result of the development of big data and the challenges it brought, a new area of Business Analytics techniques evolved (Feinleib, 2012; Mortenson et al., 2015). In line with the adoption of Business Analytics in the 2000s and 2010s, new analytical techniques emerged focusing on predictive and prescriptive outcomes (Delen & Zolbanin, 2018; Lustig et al., 2010).

In the 2010s, discussions about the definition and the associated techniques of analytics resulted in the evolution of different literature streams relating to Business Intelligence, analytical methods, and decision-making (Delen & Zolbanin, 2018). That was until Chen et al. (2012) composed the terms Business Intelligence and Business Analytics as one umbrella term, called Business Intelligence and Analytics, or BI&A, which captured all technologies regarding data processing and analysis (Côte-Real et al., 2017).

The upcoming Artificial Intelligence trends in the 2020s mark a new period in BI&A technology, called Analytics 4.0 (Andoh-Baidoo et al., 2022; Davenport, 2018). Although this period of BI&A technology is still developing, the possibilities Artificial Intelligence brings are expected to have much bigger impacts on businesses than previous technologies (Andoh-Baidoo et al., 2022).

Nowadays, the definition of BI&A by Chen et al. (2012) is still one of the most used in business research because of its broad scope of techniques (Llave et al., 2018). In several literature reviews addressing Business Intelligence and Analytics, the publication of Chen et al. appears as one of the most influential publications (Llave, 2017; Malladi, 2013; Thayyib et al., 2023). Therefore, in this research, the concept of BI&A based on Chen’s description will be used. BI&A is therefore defined as a package of tools, applications, technologies, and processes for gathering, storing, accessing, and analyzing data to generate useful business information to support decision-making (Chen et al., 2012; Moreno et al., 2020; Wixom & Watson, 2010). Although Chen et al. (2012) conceptualized BI&A as a general umbrella term, Business Intelligence and Business Analytics historically developed as two separate concepts. Thus, for the conceptualization and theoretical background of the concepts, the terms will be explained separately.

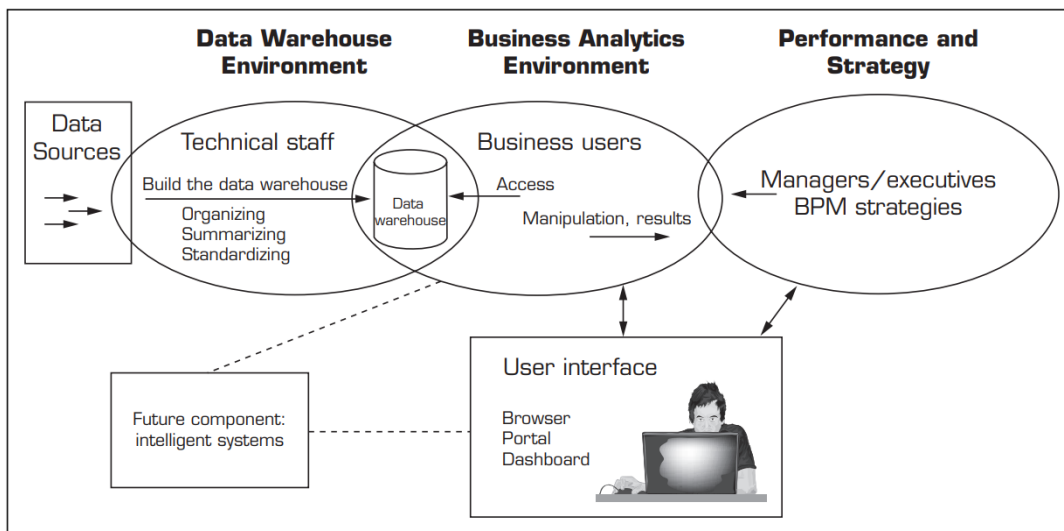
2.2.1 Conceptualization of Business Intelligence

As a result of evolving techniques in different literature fields, the conceptualization of Business Intelligence can be described through different perspectives. However, the description of Business Intelligence in line with the conceptualization of BI&A by Chen et al. (2012) is used, as BI&A is a significantly important concept in this research.

Therefore, Business Intelligence refers to the processes, methods, and technologies that support a business in translating crucial business data into easily accessible business information, enabling enterprises to understand their business and markets and make informed decisions in time (Chen et al., 2012; Coronel & Morris, 2019; Sun et al., 2018). Business Intelligence can, therefore, be conceptualized as a framework, a specific set of structured methods and technologies that is the foundation to support a certain process or concept (Coronel & Morris, 2019; Sharda et al., 2014; Sun et al., 2018).

For this reason, Business Intelligence is described as a process despite the concept also being a set of tools, techniques, and methods (Sharda et al., 2014). The process of Business Intelligence starts with raw data and ends with valuable insights for decision-makers (Sharda et al., 2014). This process of Business Intelligence consists of five interrelated elements, as presented in the Business Intelligence Architecture in Figure 9.

Figure 9: Business Intelligence Architecture



Note. Reprinted from *Smart Companies in the 21st Century: The Secrets of Creating Successful Business Intelligent Solutions* by W. Eckerson, 2003, The Data Warehousing Institute, (p. 32)

The process starts with raw data, which is extracted from **data sources** and entered into the data warehouse environment. The **data warehouse** consists of preprocessed data, which is prepared and stored to be analyzed (Jensen et al., 2010). **Business Analytics** uses techniques to analyze data from the data warehouse to develop insights. The **performance and strategy** of a business provide specific objectives and measures as guidelines for the Business Analytics environment. The **user interface** represents how information is communicated, presented, and accessed, requiring the desired reporting formats in line with the various shapes of analyzed data (Eckerson, 2003; Sharda et al., 2014).

Each element of the Business Intelligence architecture will be discussed briefly. However, Business Analytics will be addressed and conceptualized in more detail in paragraph 2.2.2. Although it is an element of the Business Intelligence architecture, it is also a crucial standalone concept of BI&A.

Data sources

As a result of technological developments, digitalization, and the availability and adoption of software and hardware, businesses can collect an enormous amount of data through a variety of systems and sources (Delen & Ram, 2018). Therefore, organizations gather data from a growing number of sources, either directly or indirectly (Sharda et al., 2014; Sherman, 2014). Organizations generate data through numerous independent systems, especially after the rise of IoT and social media platforms as sources that are full of data (Delen & Ram, 2018; Sharda et al., 2014).

Customer relationship management (CRM) systems are specifically designed for the management of clients and customers of businesses (Hariharan, 2018). Depending on the strategy and type of business, customer-specific data can generate demographics, profiles, and segments of customers. Sales data contains data about prices and transaction behaviors. Additionally, communication, marketing, and service interactions are recorded (Todman, 2000).

As human relations (HR) systems are specifically designed for workforce-related insights, they focus mainly on the internal side of businesses (Sherman, 2014). Personal employee data such as demographics and history, as well as salary, training, and performance data, are usually stored inside HR systems. Also, recruitment statistics and attendance-related data such as sick leave and overtime are important sources.

Finance and transactional systems represent one of the most valuable data sources, containing data from past and present expenditures and income (Hariharan, 2018). Cost and budget data hold information for data expenditures and strategies. Financial data consists of all transactions, balance sheets, and invoices. Profitability and revenue data represent the financial success of specific business elements (Sabherwal & Becerra-Fernandez, 2013).

Enterprise resource planning (ERP) systems are software systems mainly used to manage the operational processes of businesses; they often consist of relationships with other systems such as HR, finance, CRM, or manufacturing/production systems (Sabherwal & Becerra-Fernandez, 2013). ERP systems contain internal records such as internal documents or project management elements (Hariharan, 2018).

Alternative common internal data sources are, for example, marketing systems, supply chain systems, and internal documentation systems or archives storing internal records such as e-mails, strategy documents, or procedures and process manuals (Hariharan, 2018; Shroff et al., 2011). Other common external data sources are, for instance, market data, customer databases, governmental data, or social media platforms (Hariharan, 2018; Kinza Yasar, 2024).

Data warehouse environment

The data warehouse environment aims to store and keep the raw extracted data from different sources in one pool of easily accessible, preprocessed, and prepared data ready to analyze (Sharda et al., 2014). The data warehouse was historically developed as a solution to integrate more different data sources. A data warehouse organizes and combines data in a secure storage with reliable, up-to-date, and easily accessible data, enabling decision-makers to analyze the requested data directly (Sharda et al., 2014).

Sharda et al. (2014) and, in particular, Inmon (2005) describe a data warehouse as characterized by four key characteristics. A data warehouse is subject-oriented, which means that data is organized and accessible in specific topics such as sales, finance, or human relations. A data warehouse is integrated, which means that several data sources must be put together in one coherent format using appropriate shapes, measures, and names. Additionally, every data warehouse must have time as a crucial dimension to analyze data over different time periods. As a final fundamental characteristic, Inmon (2005) and Sharda et al. (2014) explain that a data warehouse is “nonvolatile”. This implies that

extracted, preprocessed, and prepared data cannot be changed after it is added to the data warehouse, ensuring safe data storage.

Other characteristics that often occur in a data warehouse are real-time data sources, a specific access server for users/clients of the warehouse, and a specific structure, which explains how relations between data sources are structured (Romero & Abelló, 2009; Sharda et al., 2014).

Data warehousing refers specifically to the process of transforming raw data into prepared data for analysis, which is then stored in the data warehouse (Sharda et al., 2014; Watson, 2002). This process consists of two activities that run parallel to each other: data preparation and data exploration. Data preparation consists of searching, harvesting/extracting, combining, transforming, and cleaning the data from a specific source. This process is supported by Extract, Transform, and Load (ETL) tools. Preparation facilitates that the contents (values), types, and data structures are in the correct shape (Jensen et al., 2010). Data exploration consists of the initial examination and analysis to explore and understand the data (Jensen et al., 2010). Data warehousing addresses problems in data quality and relevancy (Kinza Yasar, 2024).

Business Analytics environment

As the raw data is extracted, prepared, preprocessed, stored, and regularly updated in the specific topic pools of the data warehouse, the data warehousing process is complete (Sharda et al., 2014). The data warehouse then provides reliable, up-to-date, easily accessible data to create insights and reports. The Business Analytics environment can then access the data warehouse by connecting to it. Business Analytics uses the data from the data warehouse to generate reports, analyses, predictions, or decision alternatives based on the selected data and its corresponding performance and strategy requirements (Eckerson, 2003; Sharda et al., 2014). Business Analytics analyzes and reports insights through descriptive, predictive, or prescriptive analytics, which is covered in detail in 2.2.2.

User interface environment

The user interface environment is responsible for the information delivery to decision-makers. This process presents the communication of insights and information, which the Business Analytics environment analyzes. This process is called business reporting. Business reporting typically develops a written document, also called a report (Sharda et al., 2014; Watson, 2002). In essence, a report can be any “communication artifact” designed to present suitable and understandable information to a specific audience, where and when it is required. Reports are often independent or combinations of graphs, tables, written text, and numbers. Another feature of reports is that they are either directly accessible or periodically generated, depending on the desired subject the report should be about (Sharda et al., 2014).

In the context of Business Intelligence and its corresponding Business Analytics techniques, the user interface generally develops three main types of reports (Hill, 2008; Sharda et al., 2014).

- Statistic-based reports communicate information based on result-focused metrics or KPIs. Examples of statistic-based reports contain financial metrics such as return on investment (ROI), employee metrics such as productivity, or customer metrics like customer satisfaction score (CSAT).
- Dashboard-looking reports communicate information based on a set or combination of communication artifacts, such as metrics and visualizations regarding specific business subjects. Metrics are typically presented in graphs or tables to show a specific metric in the context of time, specific products, or other perspectives. Although dashboards are mostly built from fixed elements and structures, they often feature the ability to customize the dashboard. Examples are changing the views of graphs and tables or the possibility of adding (sub)indicators to visualizations (Hill, 2008; Sharda et al., 2014).

- Scorecard-looking reports, derived from the Balanced Scorecard of Kaplan and Norton (1992), combine different perspectives of statistic-based reports into one scorecard. The main characteristic, therefore, is multi-perspective, single-screen information communication. This presents an integrated view as several business elements are interrelated.

Nowadays, business reporting tools are developed as specific platforms to ensure the best information delivery and communication to decision-makers. Gartner's Magic Quadrant for Analytics and Business Intelligence (ABI) Platforms is a generally accepted source for researchers and managers that classifies ABI platforms (Chen et al., 2012; Sharda et al., 2014; Sherman, 2014). ABI platforms are characterized by their ability to prepare and visualize data (Richardson et al., 2020). In 2024, Microsoft Power BI, Salesforce Tableau, and Oracle Analytics were the top three ABI platforms based on their completeness of vision and ability to execute Analytics and Business Intelligence (Schlegel et al., 2024).

Business performance and strategy environment

For the data analytics and user interface to report the desired insights and information in a suitable communication artifact, business rules are needed to guide which and how insights need to be transformed into valuable statistics, dashboards, or scorecard-looking reports (Sharda et al., 2014).

These displays are derived from the performance measurement systems or specific departments (e.g., HR, finance) within a business. The business performance and strategy environment ensures that the right data is selected, appropriately analyzed with the correct method, and presented in the desired metric or visual form. The business performance and strategy environment connects the data to the business objectives and, therefore, supports informed decision-making (Sharda et al., 2014).

In the context of performance measurement systems, the system ensures that the correct perspectives are selected from the data warehouse. For example, it assigns cost-based data from the financial perspective of a particular performance measurement system that emphasizes financial performance.

Next, the performance measurement system ensures that the appropriate analytical method is used to transform the data into information through statistics, metrics, or other analytical methods. Performance measurement systems often provide key performance indicators (KPIs) as common metrics to measure the performance of a business. Furthermore, companies can design or choose their own metrics, such as pre-defined metrics such as return on investment (ROI) or customer satisfaction score (CSAT).

Finally, the performance measurement system possesses guidelines for communicating information in the user interface environment. Such systems typically need a dashboard or scorecard-looking report that presents the key performance indicators (KPIs) on one single screen for a complete view of the organizational performance. The performance measurement system can recommend information communication through metrics, visualizations, and options to dive deeper into data (Sharda et al., 2014).

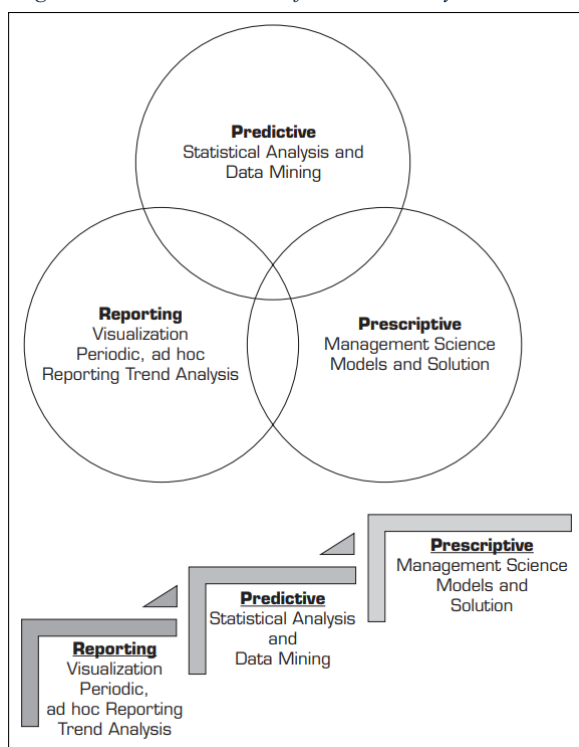
2.2.2 Conceptualization of Business Analytics

Business Analytics refers to the techniques to collect, analyze, and visualize business insights and intelligence from data (Sharda et al., 2014; Sun et al., 2018). The concept of Business Analytics developed as specific BI technology, specifically aimed at analytical techniques (Delen & Zolbanin, 2018). Looking back at the BI&A architecture and its elements as described in 2.2.1, Business Analytics, in this case, refers to the Business Analytics environment of the BI&A architecture as proposed by Sharda et al. (2014) in their book Business Intelligence and Analytics.

Literature organizes analytics techniques in different ways, and also universities vary in their explanation of Business Analytics because the concept is still developing in different fields (Delen & Zolbanin, 2018; Power et al., 2018). Other researchers, such as Balali et al. (2020) mention diagnostic analytics as the fourth level of analytics, diving deep into why events happen. However, most researchers refer to Business Analytics as a three-component concept (Sharma et al., 2022; Sun et al., 2018). Sharda et al. (2014) explain that Business Analytics consists of three levels of analytics: descriptive or reporting analytics, predictive analytics, and prescriptive analytics.

Sharda et al. (2014) argue that the three levels can be viewed in two ways, illustrated in Figure 10. The first perspective suggests that the techniques have some overlap between the levels, and they are not exactly three different techniques. On the other hand, the other perspective shows a stepwise view and suggests that advancing in one level naturally leads to the next level of analytics. As a consequence, the levels of analytics can be seen as interconnected (Aydiner et al., 2019; Sharda et al., 2014).

Figure 10: Three level view of Business Analytics



Note. Reprinted from *Business Intelligence and Analytics: Systems for Decision Support* by Ramesh Sharda Dursun Delen and Efraim Turban, 2014, (p. 20)

Descriptive analytics

Starting with the first level, descriptive or reporting analytics refers to explaining past and current business data to show what is going on in an organization. Descriptive analytics, therefore, focuses on questions such as “what happened,” “when,” and “what is currently happening” (Delen & Ram, 2018; Sun et al., 2018). This level of analytics enables decision-makers to dive into underlying trends and causes of the “is” or “was” situation (Sharda et al., 2014).

As the term describes, descriptive analytics techniques are characterized by “describing” data through reports or graphs. Descriptive statistics often summarize and display past and current data in a certain time frame (e.g., monthly) to report changes over time. The data is typically presented in a dashboard- or scorecard-looking interface with key figures, charts, diagrams, and other types of graphs (Delen & Ram, 2018). The visualization of data results in easily accessible and communicable information for decision-makers, employees, and stakeholders in organizations. Consequently, descriptive analytics

enable decision-makers to monitor business performance or base decisions on precise and up-to-date information reports or descriptions.

Predictive analytics

Predictive analytics is characterized by forecasting or estimating future business events or outcomes through prediction techniques in combination with input data (Sun et al., 2018). Predictive analytics, therefore, focuses on questions such as “what will happen”, “what is going to happen”, and why that might happen (Delen & Ram, 2018; Sun et al., 2018). This level of analytics goes beyond descriptive analytics by predicting trends and outcomes, the “could” situation (Delen & Ram, 2018).

Predicting future trends and outcomes based on existing data uses advanced techniques to estimate or forecast if, when, or what is going to happen (Sharda et al., 2014). These techniques are required to identify relationships and patterns in past and current data and use those insights to make an informed prediction of the future (Delen & Ram, 2018). Consequently, predictive analytics uses several machine learning and data mining techniques and advanced statistical systems to analyze and predict outcomes depending on the type of data (Delen & Ram, 2018; Sharda et al., 2014).

For example, regression techniques focus on continuous outcomes and try to capture relationships by plotting dependent and independent variables in the best-fitting line or curve representing a relationship or pattern (Delen & Ram, 2018). Classification techniques like decision trees, the Naïve Bayes method, or random forests try to estimate categorical outcomes, for instance, the probability of a produced car being green or red (Sharda et al., 2014). Clustering techniques such as k-means or hierarchical clustering can, for instance, categorize customers into different clusters (Sharda et al., 2014). The wide base of techniques also consists of time-series forecasting, association mining techniques, or text mining techniques (Delen & Ram, 2018; Sharda et al., 2014).

Because the various techniques have different outcome shapes, there is no typical presentation interface for decision makers. Despite this, decision-makers can base their decisions on informed estimations, predictions, or forecasts of future events or trends (Delen & Ram, 2018).

Prescriptive analytics

The third and highest level of analytics, according to Sharda et al. (2014), is prescriptive analytics. Prescriptive analytics focus on questions such as “what should we do?”, “what should happen if?” and why that should happen (Delen & Ram, 2018; Sun et al., 2018). Prescriptive analytics goes further than predictive analytics by not only estimating or predicting future outcomes, but also recommending what actions decision makers have to take to realize desired results. Therefore, prescriptive analytics support decision-makers in recommending what they “should” do (Delen & Ram, 2018).

The techniques with respect to prescriptive analytics are developed in a way that they should recommend the best possible decision based on the input data. As a result, simulation and optimization techniques are very common in prescriptive analytics (Delen & Ram, 2018).

The outcome of prescriptive analytics is often one or more decision recommendations. For example, an outcome can be a simple yes or no but can also be a specific numerical value. Other outcomes can be a commercial price for a product, a marketing strategy, or recommended inventory levels for a certain month (Delen & Ram, 2018; Sharda et al., 2014; Sun et al., 2018). Outcomes are either presented in a report or integrated directly into a system developed to autonomously and automatically make decisions based on the recommended alternative (Sharda et al., 2014).

To conclude, prescriptive analytics is the most advanced analytics level, as it contains descriptive, predictive, and prescriptive elements. The analytics level analyzes the current situation, predicts future situations, and prescribes decision-makers which actions they should take to get the desired performance (Delen & Ram, 2018; Sharda et al., 2014).

2.3 Balanced Scorecard in BI&A architecture

In summary of these theories, the following Table 3 describes the role of the BI&A architecture, which captures the elements, tools, and methods for transforming data into understandable information, as well as the performance measurement system, in one structure.

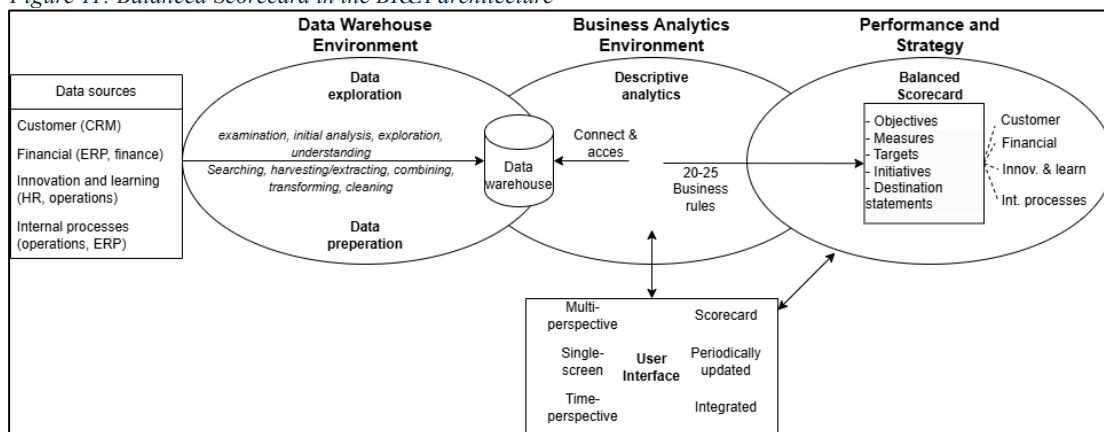
Table 3: The role of performance measurement systems in the BI&A architecture

BI&A element	Goal	Aspects	Outcome
Data source	Generation and collection of relevant data to measure	Internal and external business data sources.	Providing data sources for the data warehouse to evaluate.
Data warehouse	Data exploration, preparation, and storage	Subject-oriented, integrated, time-related, and nonvolatile	Stored, explored, prepared data readily accessible for analysis
Business analytics	Analyze insights and information from business data	Descriptive, predictive, and prescriptive analytics	Descriptive metrics, visualizations, estimations, forecasts, or decision alternatives
User interface	Information delivery through communication artifacts	Metric-based, dashboard-looking, and scorecard-looking report formats	Understandable information, clearly communicated to managers
Business performance and strategy	Providing guidelines from business strategy and objectives	performance measurement system and strategy: objectives, measures, targets, and initiatives	Business objectives, measures, guiding requirements for data, analytics, and reporting methods

Note. Own work

The Balanced Scorecard applies to the business performance and strategy element of the BI&A architecture. Therefore, it selects between 20 and 25 objectives, metrics, targets, and initiatives divided over four perspectives based on the organization's strategy. These selections function as input for the BI&A architecture as they suggest which preprocessed data from the various topics (e.g., HR, finance) in the data warehouse needs to be analyzed. Also, the Balanced Scorecard supports appropriate analytical methods to transform the data into information through statistics, metrics, or other analytical methods. The emphasis is mainly on descriptive analytics, with indicators having quantifiable and time-bound goals. Lastly, the BSC proposes a scorecard-looking user interface in which all objectives, measures, targets, and initiatives are viewed on a single screen, providing multi-perspective information communication. Figure 11 presents a visual representation integrating the Balanced Scorecard in the BI&A architecture. This theoretical integration will be applied in practice to assess the applicability, benefits, and drawbacks.

Figure 11: Balanced Scorecard in the BI&A architecture



Note. Own work based on *Smart Companies in the 21st Century: The Secrets of Creating Successful Business Intelligent Solutions* by W. Eckerson, 2003, *The Data Warehousing Institute*, (p. 32)

3 Methodology

The methodology section describes the research design, sample and selection processes, data collection and analysis processes, and the process of achieving a final design.

3.1 Research design

The research design presents the procedure that underlies the selected methods and research approach to answer the main research question, also called the methodology (Crotty, 1998). This research takes a design research approach. Design science research (DSR) is a scientific problem-solving research approach that aims to expand human knowledge, emphasizing developing a useful artifact or theory as the main deliverable of the research (Hevner et al., 2004; Vom Brocke et al., 2020). That artifact or theory offers a solution to a real-world problem. Design research often refers to the design cycle, a set of steps defining a full design process, starting with problem identification and ending when a valid design is reached (Edelson, 2002).

The design science research paradigm is mostly based on Sciences of the Artificial, which explores how artificial systems, man-made systems, can be researched while using a scientific perspective (Simon, 1969; Vom Brocke et al., 2020). Product design and development by Ulrich and Eppinger (2016) is used as the main design research methodology, defining the steps of the process. Furthermore, the Information Systems Research Framework by Hevner et al. (2004) derives from the design science paradigm. It has proven to be successful in information systems (IS) and technology (IT) research (Brocke et al., 2012).

Design research is particularly suitable for this research, as it is characterized by applying scientific sources (theories and methodologies) to a phenomenon or problem that is researched in a specific environment. The challenges of the design process in the context of the case provide new knowledge for other researchers. Because of those characteristics, design research is especially successful in balancing rigor and relevance in scientific research, contributing to both scientific literature and the problem space. A drawback of design research is that completing the full cycle is difficult, mostly because, in practice, no final design can be reached in time. Also, although the problem and specification process can be supported by well-known data collection and analysis methods, the process of creating and designing concepts or final products may be less backed by research methods as it requires more creative and trial-and-error techniques (Ulrich & Eppinger, 2016).

The design research will be conducted for a Dutch mid-sized construction company, which serves as a representative setting to answer the research question. The main research question will be answered by going through five phases of the design research process.

In **phase 1**, data for the requirements and criteria for the desired performance measurement is researched through semi-structured interviews with lead users and a review of relevant strategy documents. A ‘statement template’ is filled with interpreted needs for each interview and document.

In **phase 2**, data on the current situation regarding the performance measurement and BI&A systems is collected through semi-structured interviews, a strategy document review, and an observation of the current BI&A systems. Again, statement templates are filled in describing the current situation. ArchiMate is used as a modeling language to visualize the current BI&A systems and workflow architecture. Also, balanced scorecard specifications and indicators from relevant literature are identified, ensuring data saturation for the next phase.

In **phase 3**, the collected data is organized and grouped based on the interpreted needs and the corresponding current situation. A comparison of what is needed in the company and what is already

there in both the company and literature integrates the business needs; these are prioritized into specifications regarding the desired performance measurement and the BI&A architecture.

In **phase 4**, the specifications are translated into a concept design by applying BI&A architecture frameworks and Balanced Scorecard theories. This design transforms and is presented as a prototype.

In **phase 5**, a workshop group assesses, evaluates, and gives feedback on the designed prototype. This process is repeated until a definitive final design is reached and presented to the company.

3.2 Case selection and sample

As the research is conducted within a company, it is defined as a case. The case represents the setting and the context within the setting that is researched (Hammersley & Atkinson, 2019).

3.2.1 Case selection

The case selection describes the setting in which the research is conducted. The company is a medium-sized construction company specializing in real estate maintenance, renovations, and sustainability upgrades for existing properties in the northeastern Netherlands. As it is a Dutch company that performs construction-related activities in a region of the Netherlands, it serves as an appropriate case to address the research question. Although the organization functions as one brand with a centralized strategy, it is, in fact, made up of four subsidiaries. Each subsidiary serves a specific market segment but falls under the overarching company strategy. The company encounters and represents the construction industry-related characteristics as defined in the introduction. Dutch construction companies can, therefore, learn from the insights from this case, increasing transferability. Although the representativeness of the company is considerable, one single case does not provide generalizable evidence for the entire industry, which limits the impact of the results (Eisenhardt, 1989; Yin, 2018).

The company's suitability for the design research project was discussed beforehand. The cooperation of a design process regarding the application of the Balanced Scorecard and the design of a BI&A architecture that fits this performance measurement system was approved. Access to strategy documents and ICT systems was permitted on the condition that commercially sensitive information was not shared with stakeholders outside the research project.

3.2.2 Research units

The research objects describe the context within the research setting of the company, the units that are analyzed within the environment (Flyvbjerg, 2011). This section will describe the selection of interview participants, strategy documents, BI&A architecture documents, and the BI&A system.

For the semi-structured interviews of phases 1 and 2, lead users are selected as participants to identify the current and desired situation in the most efficient way (Ulrich & Eppinger, 2016). Lead users, in this case, represent regular users of the performance measurement systems and BI&A systems that are likely to gain significant benefits from innovative solutions (Ulrich & Eppinger, 2016; Urban & Von Hippel, 1988). Therefore, the selection of interview participants is based on the criterion that participants frequently depend on performance measurement systems and BI&A systems. Alternatively, the participant has a position or role with responsibility, experience, and expertise regarding those systems. This participant selection method is likely to provide the most powerful insights (Reybold et al., 2013). In selecting lead users, it is considered that the right mix of participants represents the real-life differences in interests and perspectives concerning performance measurement.

A total of 14 lead users participated in the interviews. The members of the Board of Directors represented the strategic expertise, whereas the operations leaders of the subsidiaries represented the tactical and operational expertise. Finally, supporting staff members were selected as experts, focusing on each of the Balanced Scorecard perspectives. The participants' positions, selection criteria, and duration are listed in Table 4. Each interview participant was randomly assigned to an interview tag (e.g., Interviewee 1, Interviewee 12) so that quotes are anonymized and not traceable to specific persons, participants, or company positions.

Table 4: Interview participants

Participant	Position	Selection criteria	Duration
TM1	Managing Director & Owner	Strategy Expert	00:39:20
TM2	General Director	Strategy Expert	00:58:50
TM3	Commercial Director	Strategy Expert	
TM4	Operations Director	Strategy Expert	00:40:45
TM5	Financial Director	Strategy Expert	01:00:45
M3	Operations manager 1	(Shared) Subsidiary leader	00:37:18
M4	Operations manager 2	(Shared) Subsidiary leader	00:17:20
M5	Operations manager 3	Subsidiary leader	00:29:09
M6	Operations manager 4	Subsidiary leader	00:53:06
M7	Operations manager 5	Subsidiary leader	00:19:49
SS	Controller	Financial Expert	01:05:50
SS	Process manager/manager Customer & Market	Internal business processes expert	00:40:26
SS	People & Development Manager	Learning & Growth expert	00:28:05
SS	Customer experience & safety manager	Customer Expert	00:28:41
SS	Data-analyst	BI&A expert	01:09:22
TM = Top manager M = Manager SS = Supporting Staff			

Note. Own work.

Furthermore Table 5 reports the participant demographics containing age groups and experience.

Table 5: Interview participants demographics

Age	N	%	Experience in organization	N	%
<30	1	7,14%	1-9 years	7	50%
30-40	3	21,43%	10-19 years	1	7,14%
40-50	4	28,57%	20-29 years	3	21,43%
50-60	4	28,57%	30+ years	3	21,43%
60>	2	14,29%	Total	14	100%
Total	14	100%			

Note. Own work

Both physical and digital documents are permitted for the strategy and BI&A documents that are being reviewed. The documents are specifically analyzed to verify and support the other data sources. For the critical finding and selection of the documents, criteria have been constructed so that only relevant documents are selected, which is in line with Bowen (2009). Complete (no drafts), recent (max. 5-year-old), comprehensive, and strategically oriented documents are selected. A list of selected strategy documents for phases 1 and 2 is provided in Table 6, containing the document type, purpose, target audience, author, and possible original sources (Bowen, 2009). Documents are also assigned to document tags (e.g., Document 1) so that sections or statements of the documents can be used in the results section.

Table 6: Document selection

Document	Purpose	Target audience	Author / authors	Original sources
DD: The Company Koersplan 2020-2023	Three-year growth plan to 2023	Internal employees	Board of Directors	Not applicable
PD: In 8 stappen naar 2026	Three-year Strategic Roadmap to 2026	Internal employees	Board of Directors	Not applicable
PD: Waarde	Becoming an impact organization through eight values	Internal employees	General Director	The Company Koersplan 2020-2023
DD: Over The Company	Mission & vision, culture, values, characteristics	External stakeholders	Marketing & Communication	Not applicable
DD: Weekrapportage	Weekly financial performance report	Board of Directors & operation managers	Controller	Administration application.
DD: 51 Board Report NO 2024	Annual Board Report supporting the annual report	Board of directors	Board of Directors & controller	Annual report
DD: Plan van aanpak 2024-2027 The Company	Subsidiary development and growth plan	Board of directors	Operations manager 1	Not applicable
DD: Ontwikkeling The Company	Subsidiary development and growth plan	Board of directors	Operations manager 4	Not applicable
PD = Physical document DD = Digital document				

Note. Own work

For the system observation, the current BI&A architecture that is used within the company is observed. This means that the researcher needs access to the systems that make up this architecture. Therefore, following the BI&A architecture of Eckerson (2003) and Sharda et al. (2014), the current data sources (databases), data warehouse, analytics tools, and user interface of the company are observed (Yin, 2018).

3.3 Data collection

The data collection method presents the techniques and procedures that are used to collect data to answer the main research question (Crotty, 1998).

An important aspect of design research is applying scientific theories and frameworks to the case. A selection of relevant and recent key theories, concepts, and frameworks are reviewed, summarized, and synthesized. Therefore, Chapter 2, the theory section, contains the essential and relevant literature

necessary to understand and implement a design process based on theoretical concepts and methods (Huff, 2009). Furthermore, paragraph 4.2.2 also contains relevant literature-derived performance indicators.

Semi-structured interviews are used to get information on the desired and current situation concerning the BI&A systems and performance measurement of the company. Using interviews is the main recommended collection method to gather data in the design and development process of Ulrich and Eppinger (2016). Semi-structured interviews are characterized by providing a balance between open conversations and a structured and standardized questionnaire. The semi-structured interview is designed and structured in a way that predefined topics and questions form an interview guide. The interview guide is included in Appendix A. During the interview, the interviewer makes sure that the conversation naturally covers the planned topics. However, in the semi-structured interview, there is room to dive deeper into topics or to deviate from the question or topic. This enables the researcher to dive deeper into unexpected statements, which can provide valuable information to the research question (Adams, 2015). Data is collected until saturation is reached related to the collected data. When the researcher repeatedly encounters the same statements or findings in interviews, saturation is reached, and enough data is collected (Grady, 1998).

Interview participants are informed about the expectations, topic agenda, and their rights a week before the interview. Interviews are held in Dutch. The interviews are audio-recorded with the permission of the participants; the audio recording is transcribed in Dutch. Quotations used in this thesis are translated into English by the researcher to maintain consistency and clarity in reporting. The translation aims to reflect the interview participants' original statements as accurately as possible.

The document analysis starts with the initial review of the document, scanning the content generally. Then, the document is read thoroughly and interpreted in the context of the document (Bowen, 2009). In this detailed review of the selected documents, relevant and informative sections, statements, and illustrations are marked, copied, and saved in a separate document (Bowen, 2009). With that, the separate document provides that relevant and insignificant sections are separated from each other, containing a selection of only informative sections ready for analysis (Strauss & Corbin, 1998). This separate document contains informative sections about the current and desired performance measurement and BI&A system use, which can be analyzed in the same way as the interview transcriptions (Bowen, 2009). Saturation here is also reached, related to the data (Grady, 1998).

Data collection from the observation of the ICT systems requires less textual data. The data collection starts by gaining access to the relevant BI&A systems. Systems are observed and monitored through their connections, interactions, and information flows. Information is documented by taking screenshots, notes, and drawings, which will be transformed into a business process model using the ArchiMate modeling language, which is part of the data analysis section. In this case, saturation is reached when the researcher encounters the same findings and data for each separate element of the BI&A architecture. This differs from the other data sources because each element must be saturated for a complete view of the total system (Glaser & Strauss, 2017).

3.4 Data analysis

The data analysis covers the first three phases of the research process. Prior to the design process, the business needs, converted into target specifications, and the current performance measurement characteristics with its corresponding BI&A architecture are identified. For the output elements, data triangulation is used to support that the findings and data are backed by multiple sources (Denzin, 2017). In this case, strategy documents and relevant literature verify and support interview statements regarding current and desired objectives and goals (Bowen, 2009).

Business needs

Firstly, the desired performance measurement, objectives, measures, targets, and initiatives of the Balanced Scorecard perspectives need to be specified for the case. These performance measurement specifications are designed based on the interview transcriptions and the (strategy) document analysis. Using both the interview transcripts and the relevant document sections as collected data, so-called data templates are filled in. The data templates are derived from the customer data templates from Ulrich and Eppinger (2016), who used data templates to identify customer needs for product innovations.

For each interview transcription and document analysis, a corresponding data template is filled in. The first column shows the questions or topics of the collected data. In the second column, the direct quotes and written statements coming from the participant or the document are filled in for the questions/topics. In the last column, the researcher interprets each statement and quote separately, converting them into specific business needs or current performance measurement characteristics. As a result, data templates covering the current and desired situation are filled in separately. An example statement template is included in Figure 31, Appendix B.

For the interpreted business needs, a complete list containing all needs is composed, and unnecessary or redundant needs are collected and eliminated. Then, from the cleaned list of needs, groups are made containing about 5-10 similar business needs express the same desire (Ulrich & Eppinger, 2016). These groups are composed based on theory, containing elements from the Balanced Scorecard and the company's strategy. Each group is given a label that represents the needs within the group.

Current situation

The current performance measurement situation also uses Ulrich and Eppinger (2016) data templates. The direct quotes, written statements from transcriptions, and document analyses are interpreted as current performance measurement characteristics. A cleaned-up list of grouped current characteristics is composed. Again, groups are labeled representing the similarity in characteristics they have. These labeled groups represent the company's current performance measurement situation.

Next, a selection of relevant performance measurement theories ensures a complete view of current performance measurement practices from both the company and the literature. This prevents the research from excluding crucial indicators or metrics not identified by the company.

To establish the current BI&A architecture of the company, a visual representation of the ICT systems regarding Business Intelligence and Analytics is developed. This is based on transcriptions, ICT system observation, screenshots, and notes. The visual representation is a process model based on the ArchiMate model notation; graphically presenting the BI&A components. This graphical view is valuable to get insights into the data flows, processes, elements, and interactions that are difficult to describe textually (Lankhorst et al., 2009). Furthermore, the ArchiMate language provides a clear process definition that is easy to communicate and interpret for decision-makers, IT specialists, and other stakeholders (Lankhorst et al., 2009).

Target specifications

To come to target specifications for the design of the Balanced Scorecard, a workshop with "multivoting" is used to evaluate the interpreted business needs independently. Again, a careful selection of at least six independent lead users is needed to participate in the workshop to pass the threshold for a reliable outcome (Ulrich & Eppinger, 2016). These lead users represent expertise and experience. Also, a mix of different types of expertise, interests, perspectives, and management levels is considered.

To check for completeness, an integrated list of Balanced Scorecard subjects coming from the business needs, current performance measurement, and relevant literature ensures a complete set of subjects. Starting with the business needs, they are combined with the current characteristics of the company, bringing together differences and similarities. Then, relevant performance measurement subjects identified in the literature are applied, preventing the company from relying on internal sources. These external insights are also combined with the set of subjects, adding new subjects to the list.

Each of the groups of business needs is presented to the workshop group shortly; the complete list of grouped business needs is numbered and shared before the workshop. This list is also included in Appendix D. The lead users are given 20 votes to prioritize the list of business needs (Ulrich & Eppinger, 2016). In multivoting, the group of lead users is asked separately to multivote on 20 of the Balanced Scorecard subjects they favor by registering a vote for them. Voting for strategic objectives is proposed by Ahn (2001) and Kaplan and Norton (1996). Sticky notes are used to vote for business needs. First, the lead users are asked to write the number of the business needs they vote for on sticky notes. Then, all the sticky notes are applied to the business needs format at the same time to eliminate the risk of votes being influenced by other votes.

When the results are put together, a list of prioritized business needs can be translated into specifications. The 20 business needs with the most votes represent which subjects should return to the Balanced Scorecard. Not only the most voted business needs are used. Throughout the design process, there is room to add 1-3 unique needs that did not receive the most votes, but from which the researcher argues that they are valuable or crucial to a successful design. Eventually, this results in 20-25 business needs that make up the 'target specifications' for the system design (Ulrich & Eppinger, 2016). Other business needs are eliminated, as the goal of multivoting is to discard business needs that are redundant and prioritize the business needs that are most important.

As a result, for each perspective of the Balanced Scorecard, an organized list of groups containing business needs, interrelated objectives, measures, targets, and goals is defined (Ulrich & Eppinger, 2016).

3.5 Design, prototyping, and final design

The actual development of the Balanced Scorecard system and BI&A architecture as a design artifact is actually a process of finding a design that best matches the specifications and fits with the applied theories and frameworks (Hevner et al., 2004). This requires an iterative process of creating and developing a system, evaluating it against the target specifications, matching it with theories, and improving the initial design. The initial focus in the design phase is on the correct application of the Balanced Scorecard theory to a construction company, applying less focus on the BI&A architecture. Consequently, the priority in the evaluation and discussion of results is based on the Balanced Scorecard, with the BI&A framework working particularly as a supporting system.

Concept design & prototyping

Following the steps of Ulrich and Eppinger (2016), a first system-level design of the Balanced Scorecard and BI&A architecture is created. This is based on the target specifications (e.g., +/- 20 prioritized objectives), the BI&A architecture framework of Eckerson (2003) and Sharda et al. (2014), and the current BI&A architecture of the company.

Firstly, the 20-25 selected objectives are adapted to Balanced Scorecard literature, applying best practices and guidelines to set up the metrics, measures, and targets. Then, by designing the BI&A architecture schematically using the ArchiMate modeling language, the design outline with the elements and their interactions is presented graphically. When it is found that the iterative process of

creating, testing, and refining the system-level design does not deliver valuable improvements to the design, the prototyping phase starts.

Prototyping is characterized by approximating what the artifact is going to be (Ulrich & Eppinger, 2016). The prototype is used to exchange the design idea —what the artifact is going to look and work like. The level of prototyping, how ‘tangible’ and comprehensive the prototype is going to be, is determined during the design process and dependent on time constraints and the progress made in the research project at the time (Ulrich & Eppinger, 2016). When the level of prototyping is defined, the development of the prototype starts until the defined level is reached. Because of these general fuzzy characteristics, the prototype can differ between a general rough sketch or a total architecture design in a digital test environment that is ready to implement.

Final design

A group consisting of five lead users within the company is composed to evaluate and give feedback on the prototype. The overall performance, impact, and changes to systems are reviewed, and feedback notes are collected so that the prototype can be refined based on these so-called ‘final specifications’ (Ulrich & Eppinger, 2016). Feedback notes are recorded using audio recording. Again, the transcript is analyzed with statement templates, interpreted business needs, and labeled groups of business needs to the final specifications.

Based on the final specifications, the prototype is refined, improved, and transformed into the finalized design. This final system, depending on its tangibility and extensiveness, will be delivered to the Board of Directors of the company as a final design and solution to the current situation. In this way, the main research question will be answered. The final design is evaluated based on the final specifications, Balanced Scorecard characteristics and its identified limitations.

The focus of design research lies in creating an applicable artifact for the problems and needs of a specific case (e.g., The company). However, considerations need to be made to assess the scalability and generalizability of the results and conclusions to the broader construction industry. To assess to what extent the artifact is applicable to other cases beyond the strategic performance measurement of The company, a part of the internal evaluation of the final design takes this into account and is part of the discussion. Also, future research could assess the practical scalability and generalizability of the conclusions of this research.

3.6 Ethical considerations

As this research requires gathering data from semi-structured interviews and strategic documents, systems, and processes, there are some considerations to be made regarding the ethical and legal requirements.

Firstly, a week before the interviews, participants are informed about the aspects and topics of the interviews. Also, an informed consent template from the University of Twente BMS faculty is used, customized, and sent to the participants. The informed consent sheet is presented in Appendix C. Each participant is required to fill out and give his consent in this form before the semi-structured interview takes place. Furthermore, before the start of the document analysis and system observation, an informed consent sheet is filled in, in which consent must be given by a responsible company manager to analyze a selection of documents and ICT systems.

With these consents, The company’s research objects can be used, and data can be analyzed from them. The data is used and processed following the university-wide research ethics policy.

4 Results

This section presents the main findings and results of the five design research phases based on the lead user interviews, the document analysis, the business needs and specification process, the concept design phase, and the final design phase. For each research phase, the approach used is described, covering the input data, the modifications, and the resulting outputs.

4.1 Phase 1: Business needs

From the 14 interviews, eight documents, and their corresponding statement templates, a total of 536 separate statements originated. These statements, interpreted and converted into business needs, describe the need coming from each separate statement (Ulrich & Eppinger, 2016). A careful consideration of the total list of business needs eliminated a small set of redundant or unnecessary business needs. Furthermore, the list of business needs is split up and organized:

- First, a set of 11 labeled groups explaining business needs covers a total of 103 needs, focusing on performance measurements in general, the design process, and ease of use.
- Then, a total of 58 labeled groups expressing the same business needs covered a total of 433 needs, focusing solely on the Balanced Scorecard perspectives.

Appendix D shows the labeled groups with the corresponding interpreted business needs within groups. Below, the findings of both sets of grouped business needs expressing the requirements, criteria, and desired characteristics are summarized and explained separately.

4.1.1 Performance measurement

At the strategy level, a desire for a long-term strategy (5-7 years) that reflects the mission and vision of the company should be supported by a medium-term strategy (3 years). Company-wide objectives should be set, measuring the performance for both the medium and the long term when this long-term strategy is implemented in the company. Thus, reports should always incorporate trends within the strategic terms. Furthermore, evaluating the long-term strategy indicators should ensure an informed reconsideration decision of the long-term strategy halfway through the cycle: *“But then you have the long-term strategy that explains where we are eventually going. And after three years you know if you did too much, too little, or just the wrong area, then you can adjust that. You should not keep doing what you did for seven years, that does not work out”* (Interviewee 10).

For each of the four subsidiaries, annual objectives reflecting the company’s strategy should be determined for every fiscal year, starting on the 1st of January. Annual objectives should be determined by the board of directors in consultation with the operational manager responsible for each subsidiary. To make an informed decision, performance objectives and targets can only be set when a baseline measurement is conducted prior to the financial year: *“If you want to measure things, then you need to have a zero situation to create a new situation, otherwise you can’t measure where you stand”* (Interviewee 4). This informed decision for the annual objectives or targets should be supported by a growth, continuity, or decline focus decision, linked to the company’s strategic goals.

To enhance a successful strategy execution, operational managers must have an incentive to achieve objectives, such as a financial reward: *“You can attach a financial delta for our operational managers. At the end of the year, you see which objectives have been achieved, you attach a certain profit distribution to it and that is rewarded to the managers”* (Interviewee 9).

As the annual objectives are expected to represent the medium- and long-term strategy, and a future compensation for achieving objectives is attached to that, adjusting the annual objectives halfway through the year does not represent successfully executing a strategy: *“With regard to adjusting objectives throughout the year, I am more of a stick-to-the-plan approach. If you, as responsible person, are very receptive to adjusting objectives, you have to ask yourself how much value setting the objectives has in the first place”* (Interviewee 8). Other experts question this by arguing that adjusting objectives can challenge and motivate managers even more if the adjustment positively influences the company’s performance: *“Actually, you should only be allowed to adjust objectives upwards”* (Interviewee 9).

With regard to the measurement and indicators reporting the performance of the company, experts note the influenceability of each indicator: *“An indicator must be influenceable in your daily work; if you work with it, then you must be able to motivate your people. You must be able to activate your people. They must enjoy using processes. They must understand that those processes maybe will not take them further, but they will bring the company further. If you can achieve that, you are really supporting.”* (Interviewee 10). On the other hand, the influenceability of an indicator must be limited in a way that manipulating measurements, calculations, or reports is minimized within the process.

Assessing the applicability of a strategy to different subsidiaries, experts mention that the shared uniform strategy should result in reporting for the same subjects, however, the goal, objective, target, and initiatives can differ for the subsidiaries: *“The subsidiaries are quite different from each other. For one, it is much more difficult to achieve or realize something than for the other. You have to appreciate them on their own. For the directors and owner of the company, it is obviously important to look at the total, but it is equally important to assess them on a subsidiary level. I would be in favor of seeing both at a glance”* (Interviewee 3). Reports should, therefore, show both the consolidated performance and the subsidiary performance on each selected subject at the same time.

Focusing on the Balanced Scorecard, experts with experience using the performance measurement system note the importance of adopting the Balanced Scorecard as a fixed part of the Business Performance Management (BPM) process: *“I firmly believe in a Balanced Scorecard, provided that we use it as a means to influence things and to show how the organization works”* (Interviewee 9). This requires regular monitoring, checking, and acting on the reported results. Such as in meetings of the Board of Directors and the Supervisory Board: *“I think you should know at least once a month, where are we, what is the trend, and how are we going there? I think a Balanced Scorecard is also a foundation for the board of directors meeting, it must be on the agenda in my experience”* (Interviewee 8).

A widely shared need is that insights into the Balanced Scorecard should be restricted to the Board of Directors, Supervisory Board, and the operational leaders on their subsidiary level only. Also, although operational leaders of the subsidiaries describe the need to share their subsidiary performance with the middle managers to influence and motivate them, a careful approach to showing performances is recognized: *“I think insights lead to actions. The more you show to everyone, the more people also become aware. So, it all has actions after that. You have to think carefully about what the consequences are of showing performances to people”* (Interviewee 12).

A further deep dive into the roles and insights shows a desire for an employee-friendly user interface for performance sharing. Employee-friendly focuses less on facts and numbers: *“You can ask yourself, who do you present it to? I actually think it is okay to share a Balanced Scorecard with your employees. Otherwise, you do not get any commitment. However, there is a limit to what you communicate. But I think that there are a lot of things that you can share quite anonymously”* (Interviewee 3). This employee-friendly scorecard could even be used for external stakeholders or commercial purposes. This desire comes from the company’s transparency core value: *“In everything*

we do, we strive to be open-minded and transparent. Proud, open, and transparent in the collaboration with our clients, residents, co-makers, and our people” (Document 6).

Reporting performances should be updated live or at least once a week. The frequency of monitoring depends on the level the performance measurement is aimed at. On the subsidiary level, weekly monitoring of performances in consultation with middle management ensures that operations can be adjusted in time. On the level of the Board of Directors and the Supervisory Board, a monthly or periodical (every four weeks) review is preferred: *“But I do think it is logical, not so much from control, but to keep sharp: Where do we stand as a company? Can we adjust where necessary? If you do that once a year, you are always catching up on the facts. I think you should know at least once a month” (Interviewee 8).*

With regard to the design of the Balanced Scorecard, the use of the current Microsoft 365 technology service is encouraged. The current Microsoft 365 license already provides access to MS Power BI software as Business Analytics environment tool. Furthermore, a connection between MS Power BI and MS SharePoint as the company’s user interface offers easy access and integration of the Balanced Scorecard into the daily operations and insights of the company.

Besides, the use of Microsoft 365 technology for the data exploration and data preparation tools of the Data Warehouse environment is also preferred. The MS Azure Data Factory (ADF), MS Power Automate, and MS Copilot are all concerned with extracting, exploring, analyzing, and summarizing the data coming from the data sources.

In total, Table 7 reports the labeled groups, describing the business needs for the performance measurement in general, the design, and ease of use:

Table 7: Performance Measurement Labeled Business Needs Groups

Labeled Groups	
1. Medium- and long-term strategy & objectives	6. Consolidated and subsidiary level reporting
2. Annual subsidiary objectives based on strategy	7. BSC as fixed part of the BPM process
3. Incentives	8. Restricted access and insights managers
4. Annual subsidiary objective adjustments	9. Transparent performance reporting for internal & external stakeholders
5. Influenceability and manipulability of indicators	10. Report & monitoring frequency
	11. Applying Microsoft technology services

Note. Own work

4.1.2 Balanced Scorecard perspectives

Customer

Starting with the customer perspective, focusing on how customers look at the company as Kaplan and Norton’s first Balanced Scorecard perspective. A total of 12 labeled groups of needs were derived from interpreted business needs from the interviews and document analysis. A brief summary of the findings on business needs is provided below. The complete list of the grouped business needs with corresponding indicators and underlying needs can be found in Figure 32 of Appendix D.

To assess the performance from the customer’s perspective, firstly, the total performance of clients should be clear. What is and was the distribution of different clients over the years? What is the revenue size and growth or decline of clients in total and per subsidiary?

A strong need to assign clients into different client types is needed to assess performances: *What is your clientele? How do you see clients? Where do we get the most revenue? How big is your independence or dependence on client types? We do not do anything with that yet” (Interviewee 13).*

On the client type level, the dependence and, thus, the performance of housing associations as a big client type is pointed out regularly. Another point of interest coming from the interviews is the need to be able to dive deep into (big) specific clients' performances. Furthermore, for the continuity of the company, a focus on the growth in long-term partnership contracts reflects sustainable relationships. This enhances steady higher revenue and thus requires attention.

Furthermore, a need to focus on the relationship types of clients further intensifies the performance of diverse types of clients: *"We need to make a selection of our A-clients, our B-clients, and our C-clients. C-clients are, for example, clients who do business with us once every ten years, B-clients visit us regularly, and the A-clients are the clients that you have to make a living from"* (Interviewee 8).

As a result, the performance of the offer portfolio, the offers that stand out at a certain moment. And the performance of the order portfolio, the signed order projects that have not yet started, measures future market positions. This reflects commercial performance with different clients.

Although hardly measurable, the company's market share is sporadically mentioned. The same applies to researching the company's brand awareness. This also has to do with the quality and performance of social media channels as important leading indicators for reach, engagement, and customer interactions that reflects brand awareness.

Lastly, the company's mission, vision, and strategy all emphasize a high score on customer satisfaction and resident satisfaction as essential indicators of organizational performance: *"We carry out our work on a grade of 8 and focus even more on customer experience than we already did. An 8 for employee satisfaction, customer satisfaction, resident satisfaction, and supplier and co-maker satisfaction"* (Document 2).

The interpretation of the statements, converted into business needs grouped together, reveals the following 12 labeled business needs groups in Table 8:

Table 8: Customer Perspective Labeled Business Needs Groups

Labeled Groups	
1. Social media	7. Customer satisfaction
2. Partnership contracts	8. Client relationships
3. Brand awareness	9. Total clients
4. Specific clients	10. Client type
5. Market share	11. Order portfolio
6. Resident satisfaction	12. Housing association dependency

Note. Own work

Internal business process

From the internal business process perspective, the processes that companies should excel at, a total of 15 labeled groups of needs originated from the interpreted business needs coming from the interviews and document analysis. A brief summary of the business needs findings is provided below. The complete list of the grouped business needs with corresponding indicators and underlying needs can be found in Figure 33 of Appendix D.

It is emphasized that for the successful completion of a project, an internal quality check should follow up to ensure that all the technical quality of the work is at the desired level for the client. Therefore, an internal quality check should be conducted for every house the company has worked in, with as few so-called 'completion points' as possible. Another way to assess quality after projects that is named is the number of complaints and warranty claims per project.

Performance on processes should be divided into types of work delivered by the company's subsidiaries to assess its performance in the different work disciplines. The same focus on the different

performance assessment types of clients on the revenue side can be applied to suppliers and subcontractors on the purchasing side, revealing dependencies, relationships, and diverse types of suppliers and subcontractors of the company.

Safety and health in general is named as must-have to assess the internal business process. Regular site inspections, (near) accident reports, and completed safety and health meetings are pointed out as must-haves to assess the quality of internal business processes.

To assess how much and how well subsidiaries collaborate with each other, reflecting teamwork, performances on internal collaborations should be tracked. The same applies to the project evaluations with customers during and after the event, assessing how business processes performed and what could be improved.

As the company depends on construction projects coming from tenders of clients, the quality, costs, opportunities, and performance of tender management are named as an important need: *“There is also the scoring percentage of the offers that were issued. I find the scoring percentage of your offers and your tenders that you issue very insightful. What percentage scoring chance do we have now? And how is that divided into the market area?” (Interviewee 9).*

On the controlling and analytical side of the internal business processes, the focus should be on signed agreements within purchasing and sales, fraud, and corruption prevention. Also, a focus on analyses of extreme projects, projects that deviate more than 10% from the project budget, is mentioned frequently.

Strategy documents emphasize the total performance of the company per year; How many houses were made more sustainable? How many houses received maintenance? What energy labels did houses receive after the company finished their work?

Other views focus on the operational efficiency of production assets. The performance of sustainable production assets, such as the effective use of the vehicle fleet and transportation, was emphasized.

Finally, although hardly measurable, the performance of the supporting staff (ICT, Health & Safety, and HR specifically) is pointed out as a subject of internal business processes to excel at, as they form a critical part of strategic development in the future strategic term. One specific need that was separately mentioned focused on the vacancy conversion of social media channels, reflecting the effectiveness of recruitment processes online.

Table 9 summarizes the interpretation of the statements, converted into 15 labeled business needs groups:

Table 9: Internal Business Process Perspective Labeled Business Needs Groups

Labeled Groups	
1. Project completion	8. Supplier/subcontractor types
2. Tender management	9. Project evaluations
3. Safety & Health	10. Total performance
4. Internal collaboration	11. Sustainable production assets
5. Deviating projects	12. Control procedures
6. Aftercare & warranty	13. Types of work
7. Supporting staff	14. Total supplier/subcontractors
	15. Channel vacancy conversion

Note. Own work

Financial

From the financial perspective, focusing on the performance of providing value for shareholders, another 16 labeled groups of needs emerged from the statement templates coming from the interviews and document analysis. A brief summary of the business needs findings is provided below. The

complete list of the grouped business needs with corresponding indicators and underlying needs can be found in Figure 34 of Appendix D.

The strength of the administrative and reporting standards the company uses explains the strong desire that retaining these standards in the financial perspective of the Balanced Scorecard was needed:

“Financially, we are incredibly strong. We know almost every minute what we are doing. That is really unimaginable: you do not see that in many companies. The way it is here, I think it is a real plus” (Interviewee 10). The key figure is the main indicator of financial performance for both the company and the subsidiaries. The key figure is composed of the sum of four financial indicator results: the overhead coverage margin result, the post-calculation result (efficiency), the financial result on sick employees, and the budget result: *“All those components are all part of that key figure. So that is actually your entire business performance, calculated back to one number” (Interviewee 3).*

Next to the reporting standards, the total periodical and forecasted revenue, costs, and profitability describe and assess the basic current and expected financial performance. The average costs/revenue per house assesses how much the costs and revenue of an average project house have changed over the years. Another specifically mentioned cost-related need indicates marketing efforts; the marketing budget spent on campaigns reflects financial input for better customer performance.

Although the interviews lack any need, strategy documents do pay attention to basic financial ratios that analyze a company’s performance, such as liquidity, solvency, activity, profitability, and leverage ratios, as important indicators of financial health.

Focusing on specific budget allocation and use, the annual budget reserved and spent on investments is named as an important leading indicator for future growth. As a result of high investments in the vehicle fleet, a specific need to assess the accounting depreciation and actual depreciation of vehicles focuses on the lagging depreciation.

Furthermore, the need for the use of EBITDA (earnings before interests, depreciation, tax, and amortization) is addressed, as EBITDA is a clear identifier of profitability when investments, and as a result, depreciation costs, are high for a company. Moreover, EBITDA is a cash-flow indicator investors and banks use to assess business value.

Finally, risk management should be incorporated into the financial perspective, as financial dependencies on big clients and also dependencies on timely payments and receivables are often named as measures for risk management.

The interpretation of the statements, converted into business needs grouped together, reveals 16 labeled business needs groups in Table 10.

Table 10: Financial Perspective Labeled Business Needs Groups

Labeled Groups	
1. Key figure	9. Revenue (turnover)
2. Overhead coverage margin result	10. Marketing performance
3. Post-calculation result (efficiency)	11. Risk management
4. Sick result	12. Invoicing/payment arrears
5. Budget result	13. Depreciation
6. Investments	14. Revenue forecast
7. Profitability	15. Financial ratio's
8. Operating cash flow/business valuation	16. Internal collaboration

Note. Own work

Learning & Growth

The last basic Balanced Scorecard perspective, learning & growth, focuses on constantly improving, innovating, and creating value for the business. As a result, nine labeled groups of business needs have

been derived from the interviews and document analysis. A brief summary of the business needs findings is provided below. The complete list of the grouped business needs with corresponding indicators and underlying needs can be found in Figure 35 of Appendix D.

A first sight at the learning & growth perspective focuses on the workforce characteristics showing the current diversity, composition, and background of the internal and external employees: *“What does our workforce look like in terms of age, diversity, background, etcetera? I can make an analysis of that in terms of salaries, inflow, outflow, and age structure. There is quite a lot of data that I can extract from that to show: How are we doing at the moment?”* (Interviewee 5). Also, the absenteeism percentage, absenteeism composition, and costs are regularly mentioned together with workforce characteristics. These specific outcome indicators reflect employee well-being and health, impacting organizational capacity and output quality.

When looking at the growth perspective, it is important that it is well documented that all employees have a personal development plan, are regularly contacted, and have meetings regarding their future development. This also includes checking that regular performance reviews are conducted as they should: *“It is about that if we have 40 people in the office here, then there must be a development plan per employee that is available. I should know that people are regularly talking with you about training and education. Then it becomes measurable for me that there is attention for someone”* (Interviewee 11). Thus, the performance results of training & education efforts over a period should also be monitored; what training programs were conducted? How much of the allocated education budget was spent? And how many hours or days of training & education did employees follow on average?

Interviewees also underscore the importance of employee satisfaction in this perspective as a lagging performance indicator of success in development efforts. Although employee satisfaction is not directly learning or growth-related, it reflects the organizational learning climate, which improves business processes.

Two standard certification efforts should be monitored well: first, the required certifications regarding safety and health for all employees should be at the expected level, and second, there should be a sufficient number of emergency response officers within the company.

As the outflow of employees requires recruitment processes for new employees, the performance of the recruitment process, especially in the construction sector, triggers interviewees' attention: *“Our processes need to be smooth and monkey-proof in a way that people don't have to wait unnecessarily for a contract or for an answer to a question. That gives a certain trust for people that things are going well here* (Interviewee 5). Other indicators focus on the vacancy performance, the interview cycle, and job interview procedure lead time.

For the continuity of the company, the recruitment of future talents is noted as an important driver for learning & growth processes. The success of recruitment processes improves the ability of the organization to improve and grow continuously.

Therefore, also performance on total interns, students, and graduates, together with the conversion rates and experienced mentors, should be monitored: *“To recruit future middle managers, we need to be at universities and colleges so that (graduation)internships of construction students join us. In this way, we do not have to start recruitment, but we can see in the internship period whether we have a potential employee”* (Interviewee 12). This statement also underscores the monitoring of network efforts such as partnerships with educational institutions, open days, guest colleges, and regularly attending network events, not only for recruitment and contacts but also for knowledge and experience sharing and discovering innovative solutions.

The interpretation of the statements, converted into business needs, grouped together, is displayed in Table 11.

Table 11: Learning & Growth Perspective Labeled Business Needs Groups

Labeled Groups	
1. Employee satisfaction	5. Interns, students & graduates
2. Workforce characteristics	6. Personal development
3. Absenteeism	7. Certifications
4. Training & education	8. Recruitment
	9. Network

Note. Own work

Corporate Social Responsibility

The interviewees did not mention the social and environmental efforts to be a competitive advantage factor of the internal business process the company should excel at. However, monitoring the performance of corporate social responsibility (CSR) practices is strategically seen as important in contributing to society and the environment for the company. Therefore, corporate social responsibility is taken as a distinct perspective of the Balanced Scorecard in accordance with Brignall (2002), who argued that CSR should be included to really balance out the scorecard, as the (social) environment is also a stakeholder of the organization.

As a result, a total of six labeled groups of business needs were derived from the business needs based on the interviews and document analysis. A brief summary of the business needs findings is provided below. The complete list of the grouped business needs with corresponding indicators and underlying needs can be found in Figure 36 of Appendix D.

Focusing on climate change and sustainability, the emissions of CO₂ should be monitored, and performance should be focused on compensation efforts and targets reducing emissions. A strong need for SMART (Specific, Measurable, Attainable, Relevant, and Time-based) sustainability goals became clear: *“You can look at CO₂ savings in all sorts of areas, right? How are we doing now, environmentally speaking? Somewhere, we share that we want to achieve a 40% CO₂ reduction in 2025. That has now already changed to 2030. We need a clearer objective”* (Interviewee 4).

Besides sustainability, circularity is also pointed out as an important subject, reflecting effectively and sustainably processing materials and waste of the company: *“There is a high focus on sustainability and actively contributing to the energy transition. Our circular ambitions are also high, so waste gets as much as possible a ‘second life’”* (Document 3). This is further monitored by focusing on transport movements to and from construction sites and company office locations, as efficient planning reduces environmental impact.

Furthermore, corporate social responsibility initiatives and investments focusing on sustainable investments and sustainable and social initiatives should be monitored: *“The company’s own CO₂-emission contribution is monitored as closely as possible and adjusted where possible through interactive responses and behavioral changes by employees and/or sustainable investments that contribute to reducing the CO₂-emission contribution”* (Document 3). These initiatives also contain performances on making houses more sustainable as they influence society and the environment outside the company.

Environmental efforts should especially be monitored through the performance of waste production and processing, as interviewees mention the heavy impact of the construction industry on waste production. This goes a step further in monitoring the circularity and recycling efforts of raw materials and waste produced by the company.

Finally, the Social Return on Investment (SROI) subject is mentioned often throughout the interviews as a term that describes the added social value to society through efforts and initiatives by the company. These include organizing open days, student visits, and guest lectures, but also creating jobs and work in the neighborhoods the company is working in.

A total of six labeled business needs groups represent the CSR perspective, presented in Table 12.

Table 12: Corporate Social Responsibility Perspective Labeled Business Needs Groups

Labeled Groups	
1. Emissions	4. Circularity & recycling
2. Environment	5. CSR initiatives
3. Social Return on Investment (SROI)	6. Mobility

Note. Own work

In summary, Phase 1 identified the performance measurement criteria and requirements for the company based on interviews and a document analysis. Additionally, for the four Balanced Scorecard perspectives and the CSR perspective, 58 grouped business needs, derived from the interviews and strategy documents of the company were identified, completing the first phase of the design process.

4.2 Phase 2: Current performance measurement & BI&A architecture

From the interviews and document analyses and their corresponding statement templates, another 254 separate statements originated. They explain the current performance measurement of the company. These statements, interpreted into current characteristics, describe how performance measurement is currently applied in the organization (Ulrich & Eppinger, 2016). From an organized list of these interpreted current characteristics, labeled groups of current characteristics are developed. The results describe how performance measurement is currently applied and, in general, how performance measurements within the Balanced Scorecard perspectives are executed.

Next, literature-derived performance indicators and metrics are explored. They represent the relevant performance measurement application evidence, currently established in theory.

Finally, a system analysis presents the systems, data sources, and BI&A architecture that are currently used for performance measurement based on the BI&A architecture of Sharda et al. (2014) and Eckerson (2003). Firstly, the grouped characteristics expressing the current performance measurement practices of the company are explained. Then, relevant performance indicators are identified, after which BI&A architecture is presented.

4.2.1 Current performance measurement

The current three-year strategic term focuses on 2023-2026, with the following strategic term focusing on 2027-2030, no long-term strategy for the company is established. The board of directors determines an annual financial revenue objective in consultation with the operational leader of the subsidiary. The revenue objective is based on historical revenue performances, realistic expectations coming from the market prognosis, and a growth, continuity, or decline decision. Moreover, objectives regarding the performance of customers, internal business processes, and learning & growth processes are also set annually between the Board of Directors and the subsidiary operational managers.

The current translation of the company's strategy into tactical and operational goals focuses on comparability between subsidiaries. Key Performance Indicators (KPIs) are currently all focused on the subsidiary level. Therefore, although subsidiaries can have different targets, the subjects and objectives that are being measured for each subsidiary are the same. Nonetheless, the measurability of the current strategy is being questioned: *"That is your strategy, your mission, and your vision. Where are we now? Where do we want to go? Now it is not really measurable, and we think; well, the market does this, so let's do that too"* (Interviewee 4). Also, with regular market and economic circumstances, annual subsidiary targets are not adjusted throughout the year.

Reporting performances is split up on the consolidated and subsidiary levels. Operational managers of the subsidiaries independently receive financial reports periodically. Performance measurements on quality, customer & market, purchasing, and human relations are executed manually and reactively when the company requires this information.

Monitoring tactical and operational goals based on the strategy is done at least once every quarter. For the Board of Directors, the performance on all objectives is not a fixed part of the periodic meeting agenda. However, the end-of-year performance, including paying off bonuses, is a fixed part. Incentives with a profit share are solely based on the revenue objective target.

Monitoring non-financial tactical and operational goals is not a fixed part of the performance measurement process. As a result, the influenceability and manipulability of non-financial indicators are not a critical part of the objective determination process.

On the other hand, the annual revenue objective, converted to quarterly, periodic (4-weeks), and weekly revenue objectives, is heavily monitored throughout the year. Interviewees note the risks of focusing on financial objectives too much: *"Pure numbers, our revenue is being checked. Money is*

number 1, 2, 3, and 4 here. As a new person here, I see that all the company is working very reactively” (Interviewee 1). Interviewees emphasize the risk of revenue objectives overshadowing the core values of the company: “Yes, but it is financially driven. I understand you have to make money. But if you start from your core values, then it has to be a part of your strategy that you are not just going to monitor financially. So, I think if it comes to an impasse between financially and core values, then financially wins” (Interviewee 10).

Focusing on the transparency of the company, a textual description of the company’s performance is shared in semi-annual newsletters for internal stakeholders only. Other expressions of performance have a commercial approach and are not specifically aimed at reporting the performance on strategy execution.

Customer perspective

The customer objective of the company that is set focuses solely on measuring the satisfaction of the customers through an average grade between 0 and 10 of all customer satisfaction scores together. As the company is mainly working for housing associations, the satisfaction score of the residents of the housing associations is the second customer objective. Both satisfaction scores are measured through external applications/services, and data is not stored internally.

The revenue distribution per type of client is currently shared as part of the periodical financial performance report. Client types and types of work are stored in the ERP application, enabling analyses of revenue and cost distributions.

The company historically works with a set of permanent suppliers and subcontractor partners, followed by an annual evaluation. As these relationships have grown stronger over time, measuring the performance of these permanent partners is an ignored part of the business operations: “*Measuring subcontractors and suppliers is less important to me, although it should be important. Because we have a lot of partners, with whom we have been working together for a long time. But actually, we never know, we just do business with them*” (Interviewee 12).

Other indications of performances from the customer perspective, such as brand awareness, long-term partnerships, and performances of specific clients, are qualitatively measured, and data is stored externally: “*The brand awareness, I think it is a good question, but it is very difficult to measure. If you look at our new logo, it is more minimalistic now. If I retire, I wish that the entire Northeast Netherlands, if they see the logo, will know who we are. Although I would like it, it is hard to measure that performance.*” (Interviewee 8).

Finally, although there is a desire to measure the market share of the company within the industry, actual data or measurements are currently not available to the company.

Internal business

Although data for tender management is stored and accessible within the company, performances have not yet been tracked or measured within the company yet. The same applies to the order portfolio, from which the current data is not used in performance measurement. As a result, a clear view of performances on the input and output of the tender processes is missing.

On the Quality, Safety & Health, and Environment aspects of internal business processes, a monthly dashboard regularly updates and reports data that is required following regulations on these subjects. Examples are reported (near) accidents, attended toolbox meetings, and regular workplace inspections.

A recent improvement in project completion processes ensures the regular use of internal completion forms on all projects so that the technical quality delivered to the client and residents is at a sufficient level. Completion and inspection subjects are measured through the internal forms application of the

company and connected to the internal data warehouse. The internal forms application also provides services for aftercare and warranty processes, collecting data on the project level and enabling measurement and analysis possibilities.

Overall performance scores and numbers used for commercial presentations are manually collected each year and not tracked or measured automatically.

Other performances of internal business processes of the supporting staff departments, such as the IT department, reception, communication, or administration, are not measured within the company: *“Looking at productivity of supporting staff processes, we measure the registered hours in relation to costs. I think we should look more into the content of those processes; take a deeper look at the processes” (Interviewee 3).*

Financial

The current financial performance report is periodically (4 weeks) manually reported through a Microsoft Excel report, which is based on export data coming from the Enterprise Resource Package. The financial reporting consists of the key figure, which summarizes the financial performance of the total company management based on four indicators, further explained in the business needs phase: *“The financial report is just in Excel because if you want to automate things, you can best try them out in Excel because of its flexibility and adjustment possibilities. Traditionally, we have a weekly report and a periodical report. We have a number of KPIs that you see there. In addition, we have the quarterly report and, of course, the annual report with the financial statements; the balance sheet, the income statement, and the cash flow statement” (Interviewee 3).*

Furthermore, the financial performance report contains extensive information about results on the project, subsidiary, and consolidated level. Performance reports include profitability, revenue generation, invoicing, and payment arrears, depreciation and amortization allocations, and revenue and cost distributions over clients, as explained in the customer perspective.

Specific revenue prognoses are currently split up between the subsidiaries and are executed manually: *“I also keep a list of revenues because I like to make my own prognosis with chances, risks, you can name it” (Interviewee 12).* Other financial measurements, such as financial ratios, investment budgets, investment expenditures, data regarding business valuation, and annual financial statements, are developed and reported when required externally.

Learning & Growth

From the interviews, the current situation of the learning and growth perspective—although Kaplan and Norton (1992) initially proposed it as the learning and innovation perspective—is mainly described by human relations subjects. Interviewees note that innovation practices remain neglected while the focus is on day-to-day matters: *“I am involved in innovations and conceptual approaches; let’s say more rolling that out because it often remains neglected. While we argue we should innovate more, in the end it does not happen” (Interviewee 4).*

An employee satisfaction survey is conducted annually, although executed through external applications/services. Other employee satisfaction is manually collected as qualitative data. Also, sick leave and absenteeism are mentioned frequently as a current measure of the learning & growth process. Data for these subjects is collected and reported manually. The current HR application enables analyses of the employee composition: *“We have our HR system; this includes our employees’ files: What does our workforce look like in terms of age, diversity, background, etcetera? I can make an analysis of that in terms of salaries, inflow, outflow, and age structure; there is quite a lot of data that I can extract from that to show: How are we doing at the moment?” (Interviewee 5).*

Recent improvements in personal development plans and periodical performance reviews of employees are executed, but not yet monitored automatically. Data regarding safety and health certificates is measured and stored automatically in the HR-Online application.

Corporate Social Responsibility

Although strategy documents often mention sustainability, circularity, being environmentally friendly, and recycling practices. No sign of any objective measurement, insights, or reports regarding these subjects is present: *“Sustainability, that is where I really want to go to, but we just do not have enough of that at the moment. We have to go to a CO₂ footprint first before you can make objectives or assign practices to it” (Interviewee 12).*

Social initiative performances are mainly textually explained, but interviewees also emphasize the lack of objective measurements: *“On a social level, I think the SROI (Social Return on Investment) is important. I think we are doing very well there, but we are not making that measurable” (Interviewee 5).*

The current situation regarding metrics, measurements, and objectives, as well as the data objects, data sources, and manual or automatic collection of the data from these perspectives, helps design the Balanced Scorecard. In summary, the current situation requires improvements in measurements from all perspectives of the Balanced Scorecard. On the other hand, the design process requires merging the current successful methods and practices of measurements and data as they remain spread across the organization: *“In general, I think we already do a lot of measurements looking at the Balanced Scorecard perspectives. However, the reporting is currently just scattered around the organization” (Interviewee 11).*

4.2.2 Relevant performance indicators from literature

In addition to the performance measurement practices and indicators currently used and desired by the company, the literature also identifies indicators and metrics relevant to this research. In the search for Balanced Scorecard subjects and indicators, literature from 16 relevant performance measurement papers has been reviewed. Care has been taken to include literature based on applying the Balanced Scorecard principles for the construction industry, on middle-sized companies, with CSR and sustainability practices, and managing DVUCA environments for an exhaustive and complete set of indicators.

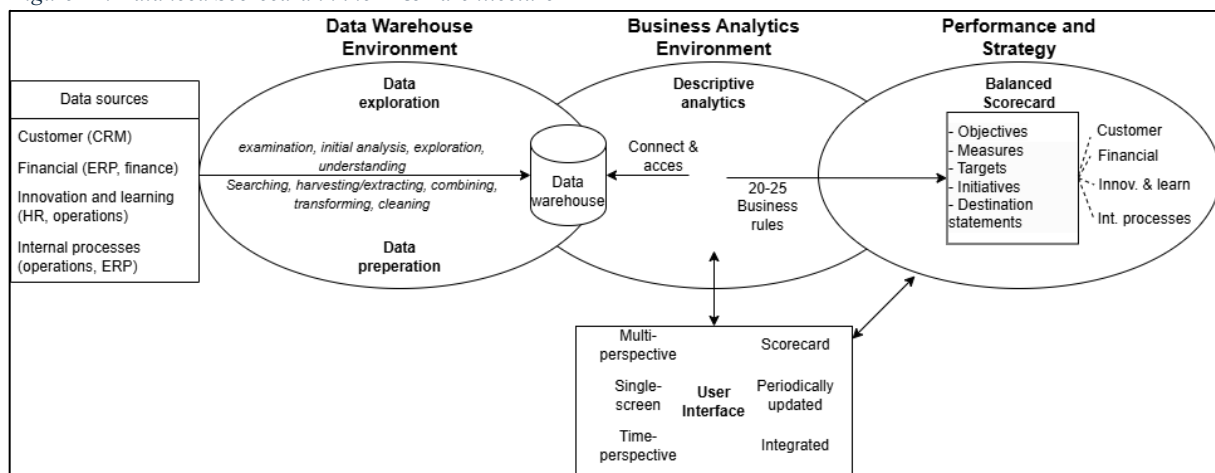
A view of current Balanced Scorecard theories in general and construction-specific studies identified a set of 94 indicators with corresponding metrics and measures. The complete list of indicators per perspective with associated references is documented in Table 20-24, Appendix E.

4.2.3 BI&A architecture

Using the BI&A architecture based on Eckerson (2003) and Sharda et al. (2014) in Figure 12, the current situation of the Data sources, Data Warehouse environment, Business Analytics environment and the User interface performance are presented.

The current characteristics of the performance and strategy environment of this BI&A architecture is elaborated in paragraph 4.2.1. Next to the textual description, the Data Sources, Data Warehouse Environment, Business Analytics Environment, and the User interface are also graphically summarized in Figure 15.

Figure 12: Balanced Scorecard in the BI&A architecture



Note. Own work based on *Smart Companies in the 21st Century: The Secrets of Creating Successful Business Intelligent Solutions* by W. Eckerson, 2003, *The Data Warehousing Institute*, (p. 32)

Data sources

The data sources consist of internal and external sources, providing data that is used for the performance measurement of the company. Starting, data sources within the company are separated as either applications or services. In general, every data source is an application. However, applications managed by the external system/application manager are characterized as external services. Working on construction sites requires employees to digitally work from secure environments; the Microsoft Azure Virtual Desktop environment enables remote working possibilities.

Firstly, Craftview Gilde is the enterprise resource package solution (ERP) the company uses for project calculations, invoices, and the total project administration for each subsidiary and the entire organization. The ERP solution has possibilities for customer relationship management (CRM) and relationship administration that the company does not completely utilize currently. The ERP solution provides project data, client/customer data, supplier/subcontractor data, and financial/offer data. As a result, the package is the main source used for the weekly, periodic, quarterly, and annual financial reports.

Project Direct is an application that arranges administrative processes regarding the hours worked by employees on subsidiary projects. Employees fill in their hours worked on projects every week. ProjectDirect has a connection to the ERP solution concerned with project administration. Currently, time registration and accounting by non-project employees, such as the supporting staff and managers, is not executed.

For the process of creating, scanning, evaluating, and approving incoming and outgoing invoices regarding all company operations, Windream Business Process Modeling is used. Windream BPM is connected to the Craftview Gilde ERP solution.

The MoreApp forms application is concerned with digitalized internal forms. The application is composed of administrative forms for the request of declarations. Next, the application provides mandatory Quality, Health & Safety, and Environment forms such as accident reports, workplace inspections, and other safety forms. The last type of forms within the application focus on the inspection forms, internal quality checks, and completion forms during the execution of projects. All filled-in forms are connected to the document management system Microsoft SharePoint 365.

The Microsoft 365 technology license is currently used as the main service package, consisting of several application solutions regarding operational, administrative, and collaboration processes. Using

Microsoft 365 technology ensures standardized use of its wide range of applications. Applications used in the data source environment are, for instance, Microsoft Excel, Microsoft Word, Microsoft PowerPoint, Microsoft OneNote, Microsoft OneDrive, Microsoft Outlook, and Microsoft SharePoint. The MS SharePoint platform is used for the total company document management and information system of projects.

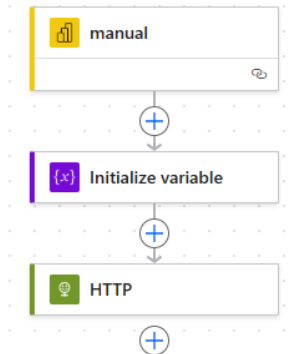
For the processing and management of personnel data, contracts of wages, absence, sick leave, personnel matters, and other human relations-related subjects, CBBS HR-Online is used. CBBS HR-Online provides the employee data. However, no connection to other applications or services (except the data warehouse) has been set up yet.

To keep the architecture clear and consistent with the research, other applications and services—including project planning, Computer-Aided Design (CAD) software, supply chain management, document management, building management tools, and fleet management—not directly influencing the current performance measurement are excluded from this architecture model.

Data warehouse environment

For the connection between the data sources and the data warehouse, two Microsoft cloud services are used. The Azure Data Factory (ADF) and Microsoft Power Automate services function as main extraction, transformation, and load (ETL) services. Both services are concerned with the extraction and exploration of the raw data coming from the sources. Microsoft Power Automate is concerned with developing automated flows that connect sources to the data warehouse and collect data automatically. The Azure Data Factory service is used as storage for collecting data from the different data sources. An automated workflow of an extraction process example is visualized in Figure 13

Figure 13: Power Automate visualized automated workflow



Note. Adapted from internal workflow visualization

The ETL services are controlled externally by the Logic Apps platform. The external business actor (Data Engineer) is concerned with data engineering and uses the Logic Apps platform to transform and process data from several sources (Data Warehouse, API, storage tables).

The transformed and processed data stored in the Azure Data Factory is then analyzed, summarized, and further explored through Microsoft Copilot. Microsoft Copilot is an AI-based cloud service focused on these tasks. Microsoft Copilot focuses on setting up datasets, automating copy and paste processes, reading out data from extracted documents, and summarizing, cleaning, or transforming big data sets.

The data warehouse itself is a specific SQL server. The data warehouse is split up into a development and production environment. Both environments are only accessible for the internal data analyst and external data engineering platform concerned with the production of databases. The development environment tests and develops databases and views. Raw data sources are stored in databases.

Prepared, filtered, and sorted data is stored into views; 'views_d' is used for the development environment and 'views_p' for the production environment. The production environment is the live environment of the data warehouse, in which data is used for live operational reports, that are accessible to the required employees.

Data is imported with cyclical refreshment eight times per day, as real-time refreshments of data result in slow reports, also called 'load'. Furthermore, the way the data warehouse is set up with prepared views does not require real-time refreshments of data.

The data warehouse follows a Snowflake schema; a type of dimensional model used in data warehousing. The Snowflake schema is a way of preparing, filtering, and storing data in the data warehouse so that it can easily and directly be integrated into the Business Analytics environment without any preparation concerns during the generation of reports, analyses, predictions, or decisions. A Snowflake schema uses facts, dimensions, and sub-dimensions. This means that every fact has its own dimensions and sub-dimensions. Although Snowflake schemas require a larger and more complex warehouse, by applying a unique identifier to each unique fact, the schema ensures that no duplicate fact is available, increasing analytics efficiency.

Business Analytics environment

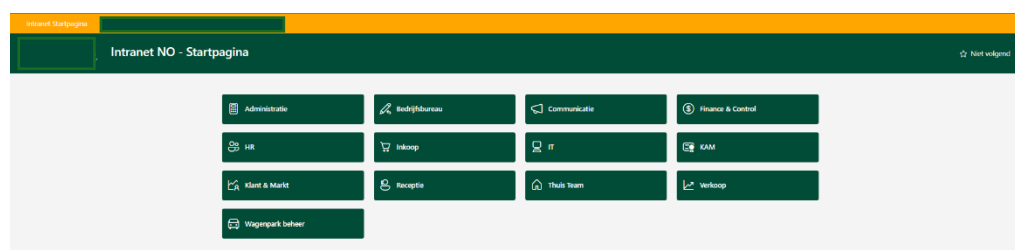
The Business Analytics environment is the Microsoft Power BI application within the company. This application/service provides specific techniques to analyze data and transform it into insights, having a wide range of data visualization solutions. The MS Power BI application has a SQL-server data warehouse connection. Because of the Snowflake schema, building relationships of the data in the reporting environment is simplified, as the unique prepared data does not need any transformation or calculation steps anymore. As a result, generating reports and dashboards is simplified into selecting the prepared data and deciding how the data should be presented, data visualization practices.

The current level of Business Analytics is focused on descriptive statistics, describing past and current situations through reports, graphs, or visualizations. Descriptive statistics use certain timeframes, such as monthly or annual reports, to show trends over time. For instance, the Power BI platform is used for Quality, Health & Safety, and environment reports, financial partnership revenue reports, and inspection and completion reports. As the Balanced Scorecard requires describing statistics, targets, and measurement reporting, the level of descriptive statistics is sufficient for BSC application.

User interface environment

The Power BI analytics environment enables integration into the Microsoft 365 SharePoint interface, presented in Figure 14. As a result, applications within the Microsoft 365 technology enable an easy integration of dashboards, reports, and visualizations from MS Power BI for different business functions. Based on the layout of the SharePoint pages, Power BI reports can be put into different team sites. Each supporting staff subject has its own team site.

Figure 14: SharePoint user interface



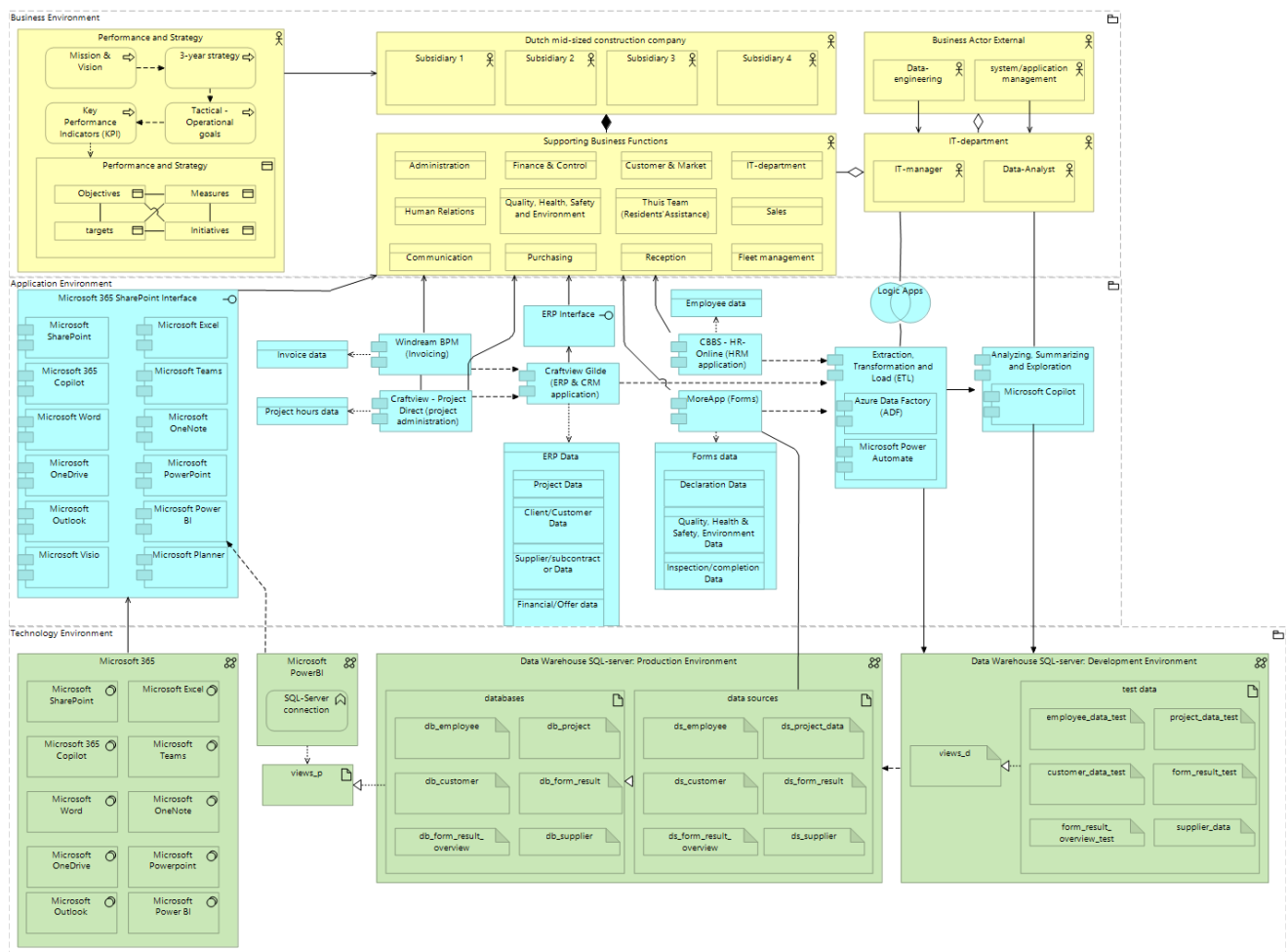
Note. Adapted from the internal SharePoint Environment

As the SharePoint environment is the main document management and information-sharing tool, future dashboards, reports, and visualizations are integrated into the different business function pages within the SharePoint layout.

BI&A architecture visualization

The ArchiMate modeling language is used to develop and visualize the Business Intelligence and Analytics environment, as its standardized modeling language enables the design of architectures covering the business environment (yellow), the application environment (blue), and the technology environment (green). Figure 15 visualizes the Business Intelligence and Analytics architecture of the company by displaying elements and connections between elements of the different environments.

Figure 15: ArchiMate Current Business Intelligence and Analytics architecture



Note. Own work.

To summarize, Phase 2 identified the current performance measurement characteristics and practices of the company. Also, 94 performance indicators coming from relevant literature sources are identified. Lastly, the current BI&A architecture is described and visualized. Altogether, these three sources describe the current situation regarding performance measurement of the company and in literature, finishing the second phase of the process.

4.3 Phase 3: Design specifications

The business needs from phase 1, relevant performance measurement evidence from literature, and the current characteristics of the company's performance measurement from phase 2 are identified. With those three sources, a detailed expression of what the Balanced Scorecard has to do can be established.

The business needs and requirements are typically described in the language of the lead user or expert. Although these business needs help in identifying important subjects and criteria, these subjective needs lack concrete, actionable design guidance. Therefore, a set of specifications is developed that clearly defines what the Balanced Scorecard must deliver (Ulrich & Eppinger, 2016).

Kaplan and Norton (1996) emphasize using indicators specifically derived from organizational strategies. However, a comparison of the business needs, identified literature evidence, and the current situation makes sure that the following steps of developing specifications are not completely based on internal views, preventing confirmation bias. A completeness check of needs, literature and the current situation is applied for both the performance measurement specifications and the balanced scorecard indicators.

4.3.1 Performance measurement specifications

Based on the business needs and current situation regarding the performance measurement of the company, specifications for the design of the Balanced Scorecard as a performance measurement tool have been developed. These specifications are listed and grouped in Table 13 and describe the key design variables that define the implementation of the Balanced Scorecard in the performance measurement process (Ulrich & Eppinger, 2016).

Table 13: Performance Measurement design specifications

1. Medium- and long-term strategy & objectives	2. Annual objectives based on strategy
- Measures follow strategic term (2023-2026)	- Annual measures starting on 1 st of January
- Long-term (5-7 year) company-wide objectives & targets	- Annual measures follow financial accounting terms
- Medium-term (3-year) company-wide objectives & targets	- Objectives on subsidiary level
- Adjustable objectives & targets in scorecard	- Objectives show last year's baseline measurement
3. Incentives	- Objectives growth, continuity or decline decision is included
- Financial deltas are linked to specific BSC objectives	4. Annual objective adjustments
- % profit share per objective	- Target adjustability restricted to upward adjustments
5. Influenceability and manipulability of indicators	- One target adjustment possibility per year
- Indicators can be influenceable by daily work	6. Consolidated and subsidiary level reporting
- Measurements reflect daily work efforts	- Equal indicators between subsidiaries
- Indicators have linked initiatives to motivate employees	- Different targets between subsidiaries
- BSC report only adjustable through Data Analyst	- Shared objective for all subsidiaries
- BSC development environment not accessible for employees	- Equal measurements between subsidiaries
7. BSC as fixed part of BPM process	- BSC shows subsidiary performance
- BSC on monthly Board of Directors meeting agenda	- BSC shows consolidated performance
- BSC on future Supervisory Board meeting agenda	- BSC can show both subsidiary and consolidated performance
- BSC on monthly subsidiary meeting agenda	8. Restricted access and insights managers
9. Transparent performance reporting for internal & external stakeholders	- BSC live access to Board of Directors
- Employee Friendly BSC live access to employees	- BSC live access to Supervisory Board
- Employee Friendly BSC only uses icons	- BSC live access to subsidiary Operational Managers

- Employee Friendly BSC does not use numbers	- No access to middle management or other employees
- Employee Friendly BSC shared in newsletters	- Restricted access to supporting staff members
- Employee Friendly BSC shared in commercial presentations for clients	10. reporting frequency
11. Applying Microsoft technology services	- BSC live updates when possible
- Using Power BI as BSC analytics tool	- BSC weekly updates required
- Integrate BSC in Microsoft 365 SharePoint as user interface	
- Apply Azure Data Factory (ADF) as ETL tool	
- Using MS Power Automate & MS Copilot	

Note. Own work

As not all interpreted needs align with performance measurement and Balanced Scorecard literature evidence, they are converted into target specifications. The researcher reconsidered the design specifications to best align the application of theory to practice while trying to satisfy the interpreted business needs (Ulrich & Eppinger, 2016). In addition to the specifications of the performance measurement practices, the limitations and critics of Balanced Scorecard named in 2.1.4, should also be incorporated as specifications of the design.

As a result, the design specifications have been adjusted to Balanced Scorecard theories, limitations, and current characteristics of the company. Below, the considerations and adjustments are described, explained, and justified.

First, showing a multi-year performance trend on objectives is not required; the destination statements already establish a quantifiable target at a specific future time point. As a result, objectives and targets are set within these clear time goals, and once the future time point is reached, new objectives can be set, confirming the adjustability and dynamic orientation of the objectives and destination statements (Lawrie & Cobbold, 2004).

Second, as the company's strategy is set for a three-year period from 2023 to 2026, no long-term strategic objectives, targets, and measures can be developed to measure the medium and long-term goals. They cannot be aligned with any underlying strategy or long-term vision. However, as the Balanced Scorecard provides a balance between measuring short-term and long-term performances, indicators and metrics should take this into account.

Furthermore, the focus of the Balanced Scorecard is to measure performance on the organizational vision and strategy from a multiple-perspective report. As a result, the design of the Balanced Scorecard is initially focused on the strategic, consolidated performances of the total organization. Although a desire to report on subsidiary objectives is regularly noted, for a complete analysis of strategy execution for the Board of Directors, the focus of the Balanced Scorecard design is on the strategy of the entire organization. Therefore, the report focuses on a consolidated level of reporting performance. Also, as the subsidiaries do not have their own subsidiary strategy, no objectives and unique indicators can be set for them. This does not affect the accessibility and monitoring frequency of the scorecard for operational managers of the subsidiaries.

Although employee-friendly and subsidiary-specific scorecards have been considered, the initial design scope keeps focus on a complete application of the Balanced Scorecard as a strategy execution performance measurement tool:

- Firstly, because strategy execution requires all subsidiaries together to perform and achieve targets. One of the four subsidiaries performing sufficiently does not mean a successful execution of the strategy for the Board of Directors.
- Secondly, employee-friendly, or commercially aimed scorecards using icons, ignoring numbers and targets, go against the initial concept of the Balanced Scorecard as a performance

measurement tool using metrics, measurements, targets, and quantitative data reporting the strategy execution performance.

The focus of this research remains on designing the Balanced Scorecard rather than implementing it as part of the business performance management process. As a result, the prototype and final design focus on the contents and supporting BI&A systems of the Balanced Scorecard rather than the implementation practices and process changes of the use of the Balanced Scorecard.

The last adjusted specification is the reporting frequency. The design specifications describe a reporting refreshment of the Balanced Scorecard at least once a week, or live when possible. As the company applies a standardized cyclical refreshment of data eight times per day for all reports, this standard is also applied to the Balanced Scorecard, ensuring alignment with the standardized BI&A processes.

As a result, the specifications regarding multi-year performance trends, long-term strategy application, subsidiary-level reporting, employee-friendly scorecards, change management processes, and reporting frequency have been removed or adjusted to align the design phase to the research.

Balanced Scorecard limitations

As the case company is a profit organization, no specifications to the design apply to non-profit or public organizational core values. However, to address the limitation of the shareholder focus, the design should replicate an equal focus on all stakeholders of the organization, including social and environmental stakeholders. As a result, an additional fifth perspective may be incorporated into the Balanced Scorecard representing a balance in stakeholder interests. This enables both an internal and external view of performances.

For the correct operationalization of objectives into metrics and indicators, existing theories and current indicator practices should be used. If both sources do not provide evidence for a correct translation, the metrics and indicators for the objective are developed and tested by the researcher.

Looking at the strategic linkage model, the focus in the design should be on coherence and logical relationships between objectives, rather than causality, as argued by Norreklit (2000).

Lastly, to take into account the DVUCA environments and static layout of the original Balanced Scorecard, adjustability possibilities should be added into the design to enhance a dynamic Balanced Scorecard applicable to fast changing environments and strategies.

4.3.2 Balanced Scorecard specifications

A combination of the 58 grouped business needs, 94 literature derived indicators and the current situation regarding the Balanced Scorecard perspectives, resulted in an integrated complete list of 79 separate subjects. The completion check resulted in 21 new subjects that were added from literature. Next, a prioritized list of the 20 most important Balanced Scorecard subjects has been developed.

This aligns with Kaplan and Norton (1996) suggestion to include between 20 and 25 objectives in the scorecard. A workshop with “multivoting” ensured an independent voting process in which six selected strategy experts or lead users each have 20 votes to prioritize their most important subjects that measure the organization’s strategy execution. A total of 120 votes were cast on the 79 subjects. The total list of prioritized subjects is ranked based on the highest number of votes. Subjects can receive one vote per participant, thus a maximum of six votes. Subjects outside the top 20 are, in principle, not reflected in the design, as the 20 most important subjects are prioritized. However, non-voted subjects are saved to be reused in the final design.

The final list of 20 subjects represents what is most important in measuring the performance of the strategy execution of the company based on the votes. As there are eight subjects having three votes, the last five subjects in the prioritized list have been established by the researcher in consultation with the Board of Directors. The shortlist of prioritized Balanced Scorecard subjects is provided in Table 14. The total list of subjects with votes is presented in Figure 37, Appendix F.

Table 14: Prioritized business needs subjects

Business Needs Nr.	Name	Total #votes
7	Customer satisfaction	6
77	Social Return on Investment (SROI)	6
10	Client type	5
17	Project completion	5
19	Safety & health	5
29	Types of work	5
47	Revenue (turnover)	5
56	Employee satisfaction	5
2	Partnership contracts	4
6	Resident satisfaction	4
11	Order portfolio	4
38	Key figure	4
45	Profitability	4
51	Revenue forecast	4
61	Personal development	4
18	Tender management	3
46	Operating cash flow/business valuation	3
50	Invoicing/payment arrears	3
52	Financial ratio's	3
58	Absenteeism	3

Note. Own work

Focusing on the Balanced Scorecard perspectives, a grouping of subjects is shown in Table 15. A total of five subjects represent the customer perspective, with an average number of votes of 4,8. The Internal Business Process has a total of four subjects, representing an average number of votes of 4,5. The Financial perspective represents the most subjects, with a total of seven out of the 20 most voted subjects and an average number of votes of 3,7. With an average of 4,0 votes, the Learning & Growth perspective is represented by three out of the 20 most voted subjects. Finally, for the Corporate Social Responsibility perspective, one subject out of the 20 most voted subjects represents the perspective. With a total of six votes, the subject has the maximum number of votes.

The 20 subjects, divided over the perspectives, will be used in the design phases of the Balanced Scorecard. As a result, objectives, metrics, measures, targets, and initiatives will be designed for these 20 subjects based on the current characteristics, Balanced Scorecard theories, Balanced Scorecard application literature, and the target specifications.

Table 15: Prioritized BSC subjects

Balanced Scorecard Perspective	Business needs	Total #votes
Customer	Customer Satisfaction	6
	Client type	5
	Types of work	5
	Partnerships contracts	4
	Resident satisfaction	4
Internal Business Process	Project completion	5
	Safety & Health	5
	Order portfolio	4
	Tender management	3
Financial	Revenue (turnover)	5
	Revenue forecast	4
	Profitability	4
	Key figure	4
	Operating cash flow/business valuation	3
	Invoicing/payment arrears	3
	Financial ratio's	3
Learning & Growth	Employee satisfaction	5
	Personal development	4
	Absenteeism	3
Corporate Social Responsibility	Social Return on Investment (SROI)	6

Note. Own work

To sum up, Phase 3 developed actionable design specifications for the performance measurement of the company, as well as a prioritized list of Balanced Scorecard subjects that should be incorporated into the upcoming design phases. These specifications present an integration of business needs, current characteristics and relevant theories related to performance measurement.

4.4 Phase 4: System-level design & prototype

Based on the target specifications for the company, Balanced Scorecard application theories and literature, and the company's current performance measurement of the company, a system-level design and prototype is developed with objectives, targets, metrics, and measurements. The prototype is presented as the outcome of the phase, reflecting a solution to the set targets (Ulrich & Eppinger, 2016).

The design first applies the Balanced Scorecard to the strategy execution and prioritized subjects of the company. This includes a strategic linkage model, destination statements, and a scorecard design based on the third-generation Balanced Scorecard of Lawrie and Cobbold (2004). Then, the metrics, calculations, data sources, data objects, and data points required for each objective are established in tables. For the operationalization of the prioritized Balanced Scorecard subjects and indicators, existing evidence from the literature and current business performance measurements is used. When no existing evidence is present, indicators and metrics are designed and evaluated by the researcher.

Using the current BI&A architecture presented in 4.2.2, a new BI&A architecture is proposed, highlighting which new elements and connections of the BI&A architecture require change to align the BI&A architecture to the design of the Balanced Scorecard.

Lastly, a reflection on the prototype design evaluates the specifications for the proposed design.

4.4.1 Balanced Scorecard design

Following the third-generation Balanced Scorecard design, the first step in the design phase of translating the strategic goals into specific measures is to ensure the links between the strategy of the company and the Balanced Scorecard. Therefore, a strategic linkage model visualizes how strategic objectives are linked with each other (Lawrie & Cobbold, 2004).

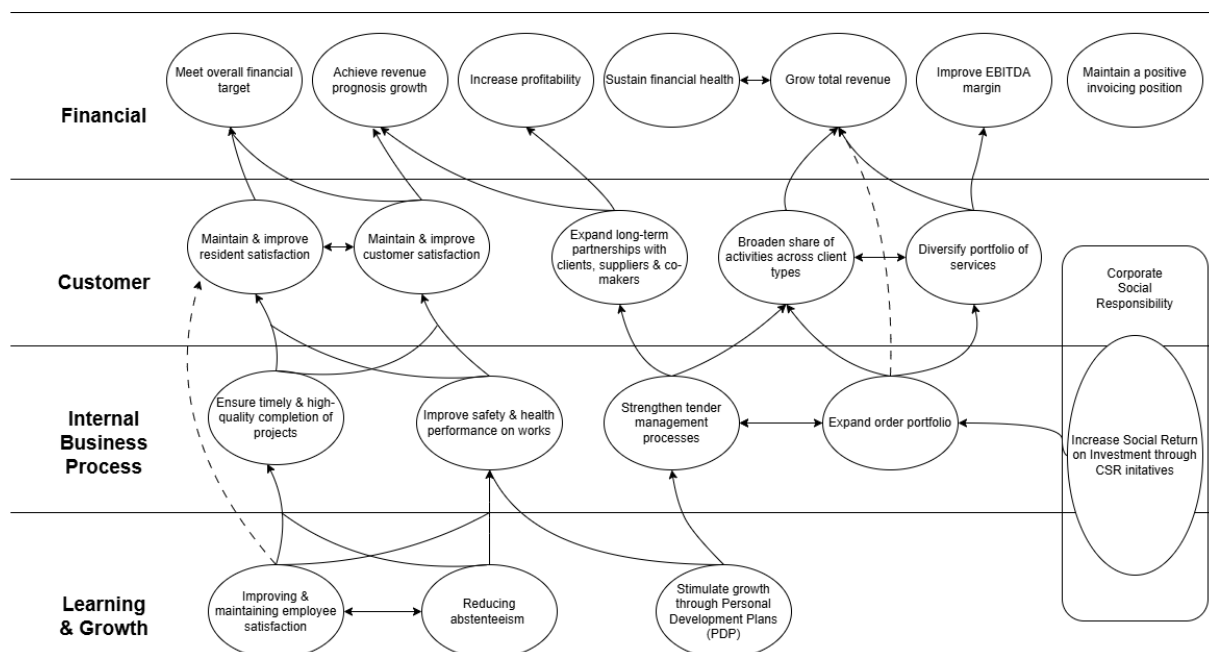
Following Butler et al. (1997) and Ahn (2001), objectives are first designed for each perspective separately before they are combined in the model. By using the senior management for the translation of the strategy into objectives, strategic expertise and experience has been applied in the design of the scorecard following the proposal of Kaplan and Norton (1996).

The strategic linkage model links the connections between strategic goals from the learning and growth perspective to the internal business process perspective, to the customer perspective, and to the financial perspective in the end. Furthermore, by applying a social-environmental dimension to the scorecard, a balance in performance measurements of all stakeholders of the organization has been taken into account (Brignall, 2002).

This design of the strategic linkage model shows logical links and coherence between objectives within perspectives, not only between perspectives following the critics of Norreklit (2000). Furthermore, links of objectives passing consecutive perspectives, directly influencing objectives further in the strategic linkage model, are highlighted by dotted lines.

The strategic linkage model visually supports the Balanced Scorecard design consisting of measures and targets in the next steps of the design process, reflecting the strategy execution measurement support rather than the measures. In the design, cause-and-effect relationships and logical relationships clearly show how performances on objectives from one perspective influence performances on objectives from other perspectives. Lastly, the short, summarized description of objectives clarifies the design of the model (Kaplan & Norton, 1996; Lawrie & Cobbold, 2004). The prototype strategic linkage model is displayed in Figure 16.

Figure 16: Strategic Linkage model design



Note. Own work

The generation of destination statements for each strategic objective resulted in clear time-bound targets. Applying targets at future dates within the strategic term (2023-2026), ensuring correctly aligned measurements with strategic execution performances. Metrics and measurements are based on either current performance measurement characteristics or Balanced Scorecard literature applications.

Destination statements are labeled and assigned to the perspective box. For example, destination statement **C5** represents the fifth objective and destination statement of the customer perspective, and **L&G2** represents the second objective and destination statement of the learning and growth perspective. Figure 17 outlines the designed destination statements in a report.

Figure 17: Destination Statements design

<p>Financial Characteristics</p> <p>FC1 - The total risk adjusted revenue prognosis growth of 2025 over 2024 is > 20%</p> <p>FC2 - The key figure at the end of 2025 > €0</p> <p>FC3 - The profit (before tax) margin of the total revenue at the end of 2025 > 10%</p> <p>FC4 -The total revenue growth of 2025 over 2024 > 15%</p> <p>FC5 - The EBITDA margin at the end of 2025 is > 15% of the total revenue</p> <p>FC6 - The average weekly invoicing delays at the end of 2025 < €0</p> <p>FC7 - Maintain a average monthly solvency ratio > 25% and < 40% and a liquidity current ratio of > 1 over 2025.</p>	<p>Customers</p> <p>C1 - The average customer satisfaction score of the company's clients at the end of 2025 is > 8.0</p> <p>C2 - The average resident satisfaction score of the company's clients at the end of 2025 is > 8.0</p> <p>C3 - A total of 2 new RGS-partnership contracts have been signed at the end of 2025</p> <p>C4 - The revenue share of the biggest client type is < 70% of the total revenue at the end of 2025</p> <p>C5 - The revenue share per single type of work does not exceed 45% of total revenue</p>
<p>Internal Business Processes</p> <p>IBP1 - The average number of completion points per house per project <4 at the end of 2025</p> <p>IBP2 - The total number of (near)accidents reported is 20% lower in 2025 then over 2024</p> <p>IBP3 - The average chance of winning tenders over 2025 >50% in both total number of tenders and € of tenders</p> <p>IBP4 - At the end of 2025, the total order portfolio in € over 2025 must be > 50% of the projected revenue of 2026</p>	<p>Learning & Growth</p> <p>L&G1 - The average employee satisfaction score of the company's employees at the end of 2025 > 8.0</p> <p>L&G2 - The average weekly sickness absence rate over 2025 is < 3,5%</p> <p>L&G3 - At the end of 2026, 100% of employees that are in permanent employment for >1 year have a Personal Development Plan (PDP) available to them</p>
	<p>Corporate Social Responsibility</p> <p>CSR1 - Increase the Social Return on Investment (SROI) from CSR initiatives by > 10% in 2025 compared to 2024</p>

Note. Own work

The destination statements ensure support for the design of the scorecard, as the generation of the scorecard design directly translates the destination statements into a graphic report.

Then, the design of the actual Balanced Scorecard represents both the strategic linkage model and the destination statements. For each perspective, the objectives from the strategic linkage model are applied (e.g., *Increase profitability*). Next, the metrics represent the indicator used to measure performances (e.g., *The profit (before tax) margin of the total revenue in %*), in this case, a ratio, percentage, score (0-10), or amount of money are applied as metrics. Metrics are directly derived from the destination statements and can also include future dates. The measures represent the raw or calculated numbers used in the report, quantitatively measuring the score on each metric (e.g., *10,83 %*). The measures represent the current performance on each objective with corresponding metric and target. The targets represent the expected quantitative performance; the measurable goal of a business regarding the objective (e.g., *10 %*). Initiatives are also part of the Balanced Scorecard and represent the concrete initiatives and actions planned to achieve the targets, and, as a result, the strategic objectives (e.g., *improving sales of high-profit products*). Measures in the report that have failed to meet the targets at that moment are highlighted in red text color.

As a result, the Balanced Scorecard presents a single-screen view, broad enough to capture the overall performance measurement of the organization. Within the scorecard, balance between non-financial and financial indicators, external and internal indicators, and lagging and leading indicators has been considered (Kaplan & Norton, 1992).

By applying 20 indicators within the scorecard, the risk of oversimplifying the performance measurement of the strategy execution has been prevented, while care has been taken into account that not too many measures cause an information overload (Kaplan & Norton, 1996).

The single-screen view of the scorecard with measures, metrics, and objectives in a tabular report ensures a clean and well-structured layout, improving the usability for users. Figure 18 illustrates the prototype design of the Balanced Scorecard.

Figure 18: Balanced Scorecard design

	Objective	Metric	Measure	Target	Initiatives
Financial	Meet overall financial target	The key figure in (€) at the end of 2025	€ -125.000,-	> €0,-	• Initiative 1
	Achieve revenue prognosis growth	risk adjusted revenue prognosis growth (%)	10%	> 20,0%	
	Increase profitability	The profit of the total revenue (%)	10,83%	> 10,0%	• Initiative 2
	Sustain financial health	Average monthly solvency ratio (%) Average monthly liquidity current ratio	35% 1,6	> 25% - < 40% > 1,0	• Initiative 3
	Grow total revenue	The total revenue growth of 2025 over 2024 (%)	>7%	> 15%	
	Improve EBITDA margin	EBITDA margin (%) of the total revenue	16%	> 15%	• Initiative 4
	Maintain a positive invoicing position	Average weekly invoicing delays (€)	€ - 21.385,-	< €0,-	
Customer	Maintain & improve customer satisfaction	Average customer satisfaction score per client	8.2	> 8.0	• Initiative 1
	Maintain & improve resident satisfaction	Average resident satisfaction score per client	8.1	> 8.0	• Initiative 2
	Expand long-term partnerships with clients, suppliers & co-makers	Newly signed RGS partnership contracts (#)	1	=>2	• Initiative 3
	Broaden share of activities across client types	Revenue share of biggest client type in total revenue (%)	85%	< 70%	
	Diversify portfolio of services	Biggest work type share of total revenue (%)	60%	< 45%	• Initiative 4
Internal Business Process	Ensure timely & high quality completion of projects	Average completion points per house per project (#)	3,7	< 4	• Initiative 1
	Improve safety & health performance on works	Annual (near) accident reports (#)	3	< 10	• Initiative 2
	Strengthen tender management processes	Average chance of winning (# & €) tenders (%)	35%	>50%	
	Expand order portfolio	Order portfolio share of 2026 projected revenue (%)	40%	>50%	• Initiative 3
Learning & Growth	Improving & maintaining employee satisfaction	Average employee satisfaction score	8,1	> 8.0	• Initiative 1
	Reducing absenteeism	Average sickness absence rate (%)	2,4%	< 3,5%	• Initiative 2
	Stimulate growth through Personal Development Plans (PDP)	Employees in permanent employment for > 1 year having a PDP	45%	100%	
CSR	Increase Social Return on Investment (SROI) through CSR initiatives	SROI ratio growth (%)	11%	< 10%	• Initiative 1

Note. Own work

Based on the Balanced Scorecard, the metrics, calculations, data sources, data objects, and data points for each objective are established in Table 25-29, Appendix G. They are essential for the BI&A architecture design and provide insights into underlying data supporting the report.

For the employee, customer, and resident satisfaction, the satisfaction index of Koprivica et al. (2021) is used. The researcher transformed the index (0-100) into a satisfaction score (0-10) that suits the destination statement and strategic expressions.

Furthermore, the research on the application of the Balanced Scorecard in the construction industry from Koprivica et al. (2021) was used to set the metrics and calculations for the revenue growth and the margins for EBITDA. To measure the profitability and the invoicing position, the performance indicators of Horta et al. (2010) were used. Other financial metrics and calculations were derived from the current weekly financial performance report.

A combination of the current measurement practices and the proposed indicators from Kaplan and Norton (1992, 1996) for partnerships and revenue presents two important customer indicators. The completion defect indicator proposed by Barros et al. (2020) and Murray (2008) was incorporated. However, the Accident Frequency Rate (AFR) by Barros et al. (2020) was rejected as the current Quality, Safety & Health, and Environment report already uses a sufficient indicator to measure safety & health performances on works. The sickness absence rate and PDP calculations are taken from the current HRM application.

Lastly, The SROI ratio calculation and metric are based on the SROI cost-benefit analysis for activities of Arvidson et al. (2013). The quantification of the value of social benefits requires subjective valuation techniques. However, to remain a quantifiable target, a comparison between two years using the same valuation techniques enables a measurable performance goal.

4.4.2 BI&A architecture design

Based on the current BI&A architecture shown in 4.2.2, a new BI&A architecture design is proposed considering the strategic linkage model, the destination statements, the Balanced Scorecard, and its corresponding data sources, data objects, and data points.

In the performance and strategy environment of the BI&A architecture, the normal performance measurement business processes have been replaced with Balanced Scorecard business processes, revealing the new flow order and elements of the scorecard.

Furthermore, prognosis data accessed by both MS Excel and Craftview Gilde is proposed as a new data object in the application environment, ensuring that the ETL tools can access the prognosis data through the connection with the Craftview Gilde ERP & CRM application based on a connection between the numbering of offers in the ERP data and the composition of the prognosis data.

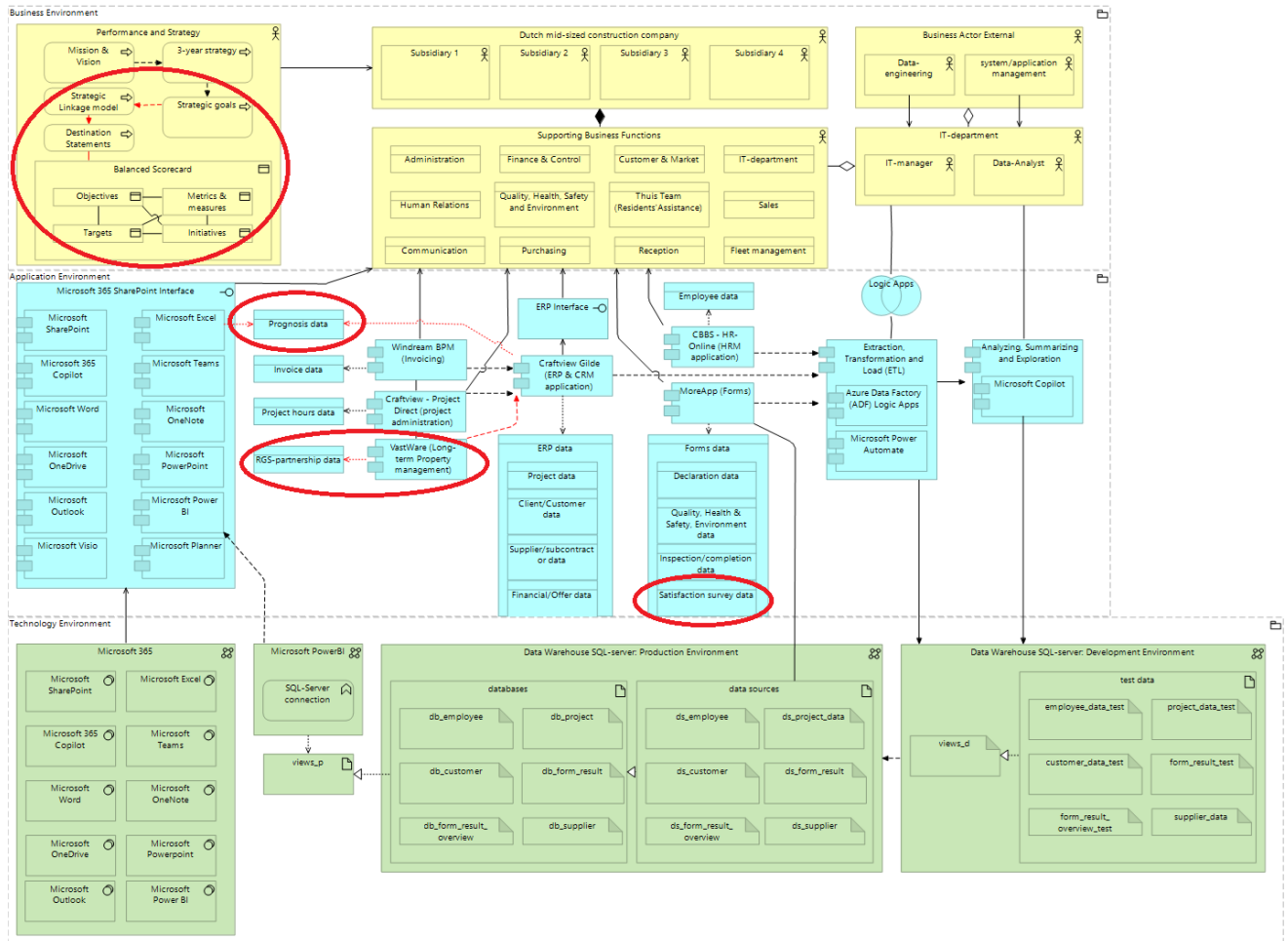
The new RGS partnership data comes from the VastWare application, which the company already uses as a tool for the management of long-term property management. In this application, the partnerships are registered. Based on corresponding project numbers, both the ERP-project data and the RGS-partnership data. This connection ensures another connection between the new data object and the ETL tools.

Finally, by standardizing the surveys of employee, customer, and resident satisfaction data within the MoreApp internal forms application, the use of an existing connection with the ETL tools enables a uniform measurement, collection, and analysis process instead of using various external survey tools.

As a result, the new data sources and data objects are connected to the data warehouse through the ETL tools. This enables the use of Microsoft technology and LogicApps control to set up datasets, databases, and views for the Microsoft Power BI solution. This set up is based on the applied Snowflake Schema and by using the standard cyclical refreshment of data imports eight times per day. The new prognosis data and RGS partnership data can be included in the existing '*project_data*' databases. The survey data coming from the forms application can also be included in the existing '*form_result*' databases in the Data Warehouse.

On the analytics and user interface side, this enables the data analyst to design reports based on existing layout structures, ensuring a well-known design with clear visuals and tables. Lastly, the possibilities to integrate the Power BI reports into the SharePoint sites of supporting business functions, such as the Board of Directors, the Supervisory Board, and the operational managers of the subsidiaries, ensures restricted access to the reports. New elements and connections in the BI&A architecture and within environments are highlighted in Figure 19.

Figure 19: Proposed BI&A design changes



Note. Own work

4.4.3 Prototype design evaluation

Looking back at the target specifications, the Balanced Scorecard correctly applies the strategic term of the current strategy from 2023 to 2026. Furthermore, annual objectives derived from the organizational strategy are shown in the destination statements with a clear target and time perspective. The clear distinction between perspectives, targets, and time perspectives facilitates the possibility for the Board of Directors to attach incentives to achieving targets, motivating the successful execution of the strategy.

Next, the destination statements with a time perspective and clear target ensure the possibility for adjustments of objectives once per year, for instance when a target at a future time point is already reached throughout a year. In the design of the objectives, destination statements, and metrics, care has been taken to ensure a balance between the influenceability and manipulability of the measurements.

Consolidated-level reporting connects the organizational strategy to the performance measurement system, granting access to the Board of Directors, Supervisory Board, and operational managers of the subsidiaries. This access makes possibilities to frequently review performances, applying the Balanced Scorecard as part of the Business Performance Management (BPM) process taking place weekly, periodically, quarterly, and annually.

The restricted access also prevents oversharing of strategic data, limiting the insights for employees, which could lead to unwanted and uncontrolled actions and initiatives among employees.

Furthermore, the new BI&A architecture adopts and utilizes the current BI&A architecture, keeping the connections between the Data Warehouse environment, the Business Analytics environment, and the user interface intact. This also means the utilization of the Microsoft technology services for extraction, transformation, loading, analysis, and visualization of the data.

In short, Phase 4 reveals the outcome of the design process, a prototype Balanced Scorecard design with corresponding BI&A architecture. The design is based on application literature, specifications, and the current characteristics of the company with its performance measurement practices.

4.5 Phase 5: Final specifications & final design

For the prototype design of the Balanced Scorecard, specifying all needs beforehand is rarely possible. Furthermore, the design phases show that not all target specifications can be met, and some specifications can even be exceeded. For this reason, the prototype design is refined based on a new set of final specifications coming from the lead users (Ulrich & Eppinger, 2016).

Based on the presented Balanced Scorecard prototype and the corresponding BI&A architecture, a workshop containing a selection of five lead users (strategy experts) is used to evaluate the performance and impact of the prototype. A total of 53 separate feedback notes were recorded from the workshop. Because of the workshop setting, consensus could be achieved over single feedback notes proposed by participants. Based on the feedback notes, statement templates are filled in, consisting of interpreted business needs. Then, a total of 29 labeled groups of final specifications is generated from the total list of interpreted business needs.

The final specifications will be presented, after which the refined and improved final design will be presented, including a description of the tradeoffs considered, changed elements of the Balanced Scorecard, and the revised version of the BI&A architecture.

4.5.1 Final specifications

Strategic linkage model

The workshop participants note the need for less overlapping and more combined arrows, together with a bigger distance between the objectives in the strategy map. This also resulted in a request to review the seven financial objectives as the ‘balance’ between the perspectives could be disturbed based on the heavy emphasis on financial performance.

Clarification on the definition of a customer resulted in the need for a renaming of ‘customer satisfaction’ to ‘client satisfaction’ in all Balanced Scorecard elements. This ensures a clear separation between the clients, such as housing associations, and the residents, the members of the housing associations representing the end user.

Next, the participants mention the need for a review of short-sentence objectives: *“Because the objectives are a fairly short description of the entire strategic objective, you should critically review each goal to see if it actually describes the goal correctly” (Participant 1).*

An extra link between long-term partnerships and the revenue growth objective is mentioned: *“Partnerships must also be linked to the regular revenue objective because these partnerships must ultimately give us a higher steady revenue stream over the long-term” (Participant 3).*

Finally, the calm appearance of the strategic linkage model received positive reactions, in which participants emphasized that the use of colors should be minimized to ensure the functionality of the strategic linkage model. The use of a legend with the strategic linkage model was discouraged: *“I think the strategy map should be clear enough without the need for a legend explaining the arrows. It should be instantly clear to me that a dotted line is skipping a perspective without the need for a legend or explanation”* (Participant 1).

The interpretation of the statements, converted into final specifications, reveals the following eight groups in Table 16:

Table 16: Strategic linkage model final specifications

Labeled Groups	
1. Clear objective links	5. Short sentence objectives review
2. Clear distance between objectives	6. Partnership-revenue link
3. Review financial indicators	7. Clear and calm appearance
4. Customer – client clarification	8. Ease of use without legend

Note. Own work

Destination statements

On the level of the destination statements, a question indicates the need for a critical review of the time specifications of the destination statements: *“Is it true that not every destination statement has an end year? If so, then it should be clear that a measurement should be at a certain level throughout the whole term. So, until the end of the strategic term”* (Participant 4).

Another interpreted need focuses on a prioritization of objectives within perspectives, sorting destination statements based on importance from high to low. Others mention the need for the labels of the destination statements to recur in the scorecard so that objectives are recognizable.

On a general note, several destination statements received comments on the need for a definition or clarification explaining what a certain indicator (e.g., key figure) means or how it is calculated.

Looking at the destination statements specifically, the need for a new objective/indicator regarding the learning & growth perspective was identified: *“As discussed earlier, I think it is good to add an extra innovation statement somewhere, focused on revenue share of innovative projects in all projects. I am thinking about innovative projects, such as projects with a conceptual approach or with a specific collaboration. The learning & growth focus is too much on the human capital and growth in the short term”* (Participant 3).

Although receiving five out of six votes in the design specification process, participants noted the work type objective (diversify portfolio of services) as redundant objective, as diversifying services should be done within subsidiaries: *“If one objective needs replacement, I think it should be the distribution per type of work. That will only become important for the subsidiaries, as they are too divided in types of work already. Once we focus on them separately, then we can set objectives per subsidiary”* (Participant 1).

Lastly, the wish to add the absolute projected revenue to the IBP4 statement gained consensus from the workshop group to make the statements better to understand.

Table 17 lists the eight final specifications regarding the destination statements.

Table 17: Destination statements final specifications

Labeled Groups	
1. Time bound specification review	5. Include leading innovation indicator
2. Prioritization of objectives	6. Clear and calm appearance
3. Recurring statement labels	7. Redundant work type objective
4. Indicator definition and clarification	8. Add absolute value to projected revenue

Note. Own work

Balanced Scorecard

A need to use red and green text colors for missed and already achieved targets, and a black text color for targets that are on track or not met yet, was the most named need within the workshop. The use of weighted objectives was marked as a step ‘too far’ to keep the initial implementation manageable. However, questions arose about the possibility of adding multiple targets per objective, for example, one target for 2025 and the next target for 2026 for the same objective.

Participants note the lack of balance between types of indicators: *“I still think that we have too many ‘effect’ indicators and need more ‘cause’ indicators within the perspectives. Look at employee satisfaction for instance, that is an effect indicator of a good learning environment. Then you automatically tackle your balance in short- and long-term indicators too”* (Participant 3). Following this note, a leading learning and growth indicator coming from literature evidence was discussed: *“Measuring the suggestions made by employees like an idea-box is very interesting. That gives improvement points from the operation. It shows whether employees take initiative and whether there is an environment to grow together. For example, we could organize an innovation challenge where we reward impactful suggestions or solutions. As far as I’m concerned, we include these in the Scorecard”* (Participant 1).

The inclusion of other literature derived indicators in the Balanced Scorecard such as predictability, training and education hours, and information system capabilities were discussed. However, they were defined as either non-critical to strategy execution, or better applicable to the performance management of specific subsidiaries than on a consolidated level.

Participants mention the irregular use of time goals within the scorecard: *“The metric you are using now sometimes does, and sometimes does not contain the end time target. Let’s either apply it to all metrics or leave them in the destination statements only”* (Participant 1).

Furthermore, the need for tabs within the total Balanced Scorecard makes it easy to switch between linkage models, destination statements, targets, and measures. Moreover, a fourth tab request is proposed: *“I actually miss a tab here, where I can see where the data comes from, which app it comes from, and which formula or calculation is used. Now, most of us already know that, but with that, you secure the entire Balanced Scorecard. Just using tables is already sufficient”* (Participant 3).

Lastly, the need for an active initiative list is noticed: *“We should also be able to add something to the action list so that we can indicate: Okay, this action or initiative has been completed. That way, you keep the report alive”* (Participant 1).

In Table 18, ten final specifications regarding the balanced scorecard are presented.

Table 18: Balanced Scorecard final specifications

Labeled Groups	
1. Colors indicate missed, achieved and targets on track	6. Time frame either in BSC or statements
2. Indicator influenceability review	6. Show calculations and data sources
3. Apply tabs between scorecard elements	7. Postpone weighted objectives for subsidiaries
4. Indicator imbalance	8. Clear and calm appearance
5. Growth & knowledge sharing indicator	9. Active initiative list
	10. Consider multiple targets per objective

Note. Own work

Business Intelligence & Analytics architecture

In the BI&A architecture design, participants recognize the intention of a complete view diagram. However, the participants mention that the number of elements and connections results in a confusing report. Furthermore, the need for a legend indicating what colors, icons, and connections mean was identified. This matches the last need proposed by the workshop participants, being that not only the new elements in the architecture but also the new connections in the architecture should be highlighted clearly to show their influence on the BI&A architecture.

The interpretation of the statements, converted into final specifications for the Business Intelligence and Analytics architecture, reveals the following three specifications in Table 19:

Table 19: Business Intelligence and Analytics architecture final specifications

Labeled Groups	
1. Clear intention, unclear diagram	2. Apply legend
	3. Highlight new connections

Note. Own work:

As a result, the prototype design will be adjusted to these final specifications, revealing the final design.

4.5.2 Final design

The final design consists of the strategic linkage model, the destination statements, the Balanced Scorecard, the Calculation and Definition tab, and the final BI&A architecture based on the final specifications.

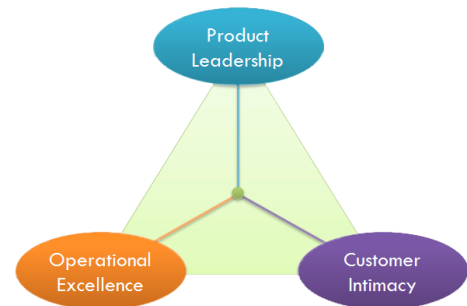
Strategic linkage model

In the final design of the strategic linkage model, newly combined and better understandable links are drawn. Also, a review and change in the diagram and the distances between the objectives further improves the usability, together with a critical review of the short sentence objectives. The customer satisfaction objective is rewritten into client satisfaction in all Balanced Scorecard elements for a better separation between clients and residents.

The need to include an innovation objective in the learning & growth perspective is further justified by looking at the value disciplines of Treacy and Wiersema (1993), visualized in Figure 20. In the development of value disciplines, Treacy and Wiersema argue that companies should focus their strategy on one or two of the three value disciplines: Product Leadership, Customer Intimacy, and Operational Excellence. However, in this strategic focus, the other value discipline should at least achieve sector standards (Treacy & Wiersema, 1993). The customer intimacy discipline and the operational excellence are both well represented in the Balanced Scorecard through the human relations aspects, satisfaction measurements, partnerships, and process developments. However,

indicators or objectives of product leadership, characterized by innovativeness and creativity, remain underrepresented. As a result, the focus in the learning & growth perspective is mainly on short-term performances. A look at innovative projects focuses on long-term continuity, balancing out the leading and lagging indicators on performances.

Figure 20: Value disciplines



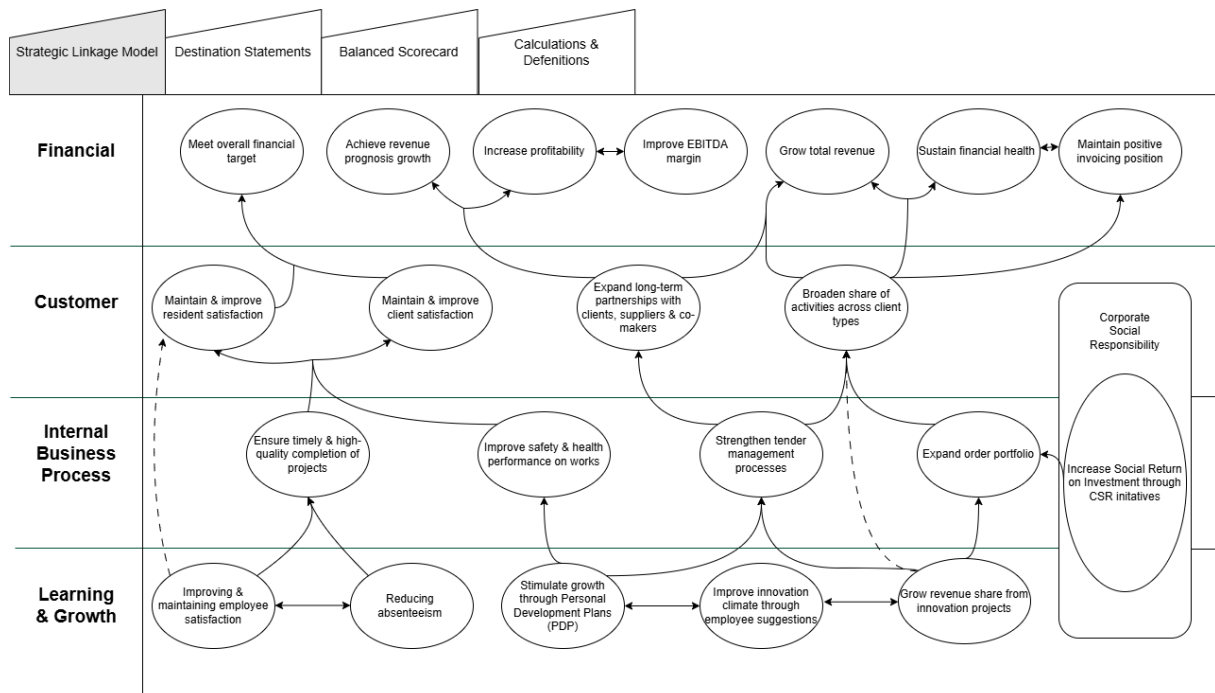
Based on the focus on innovative product portfolio management of Cooper et al. (1999), the choice for a percentage-based objective is used. This represents a formal method that helps to take all projects as the total portfolio and the share of innovative projects to balance low-risk and high-risk projects and short- and long-term-oriented projects. As innovative projects ensure continuity in the organization (Cooper et al., 1999).

Secondly, a leading indicator for the learning and growth perspective is added. Proposed by Kaplan and Norton (1996), to measure the degree of motivation, initiative and growth environment in the company, the number of suggestions per employee is added. A higher number of improvement suggestions indicates a climate for action, as well as improvement and innovative ideas. These ideas and suggestions, when followed up correctly, could speed up improvement and innovation processes.

Note. Reprinted from *Waardestrategieën Treacy en Wiersema, Mitch Eelants, 2018, (p. 3)*

By applying two new short-sentence objectives in the strategic linkage model (e.g., *Grow revenue share from innovation projects*, and *Improve innovation climate through employee suggestions*), the new indicators are included in the linkage model. Also, the redundant objective and its corresponding links were removed from the model. Resulting in a more balanced strategic linkage model, having at least four objectives per original Balanced Scorecard perspective. Consequently, the reconsideration of the use of seven objectives from the financial perspective did not result in any adjusted or eliminated objectives. Figure 21 illustrates the final strategic linkage model, based on the final specifications.

Figure 21: Final Strategic Linkage Model

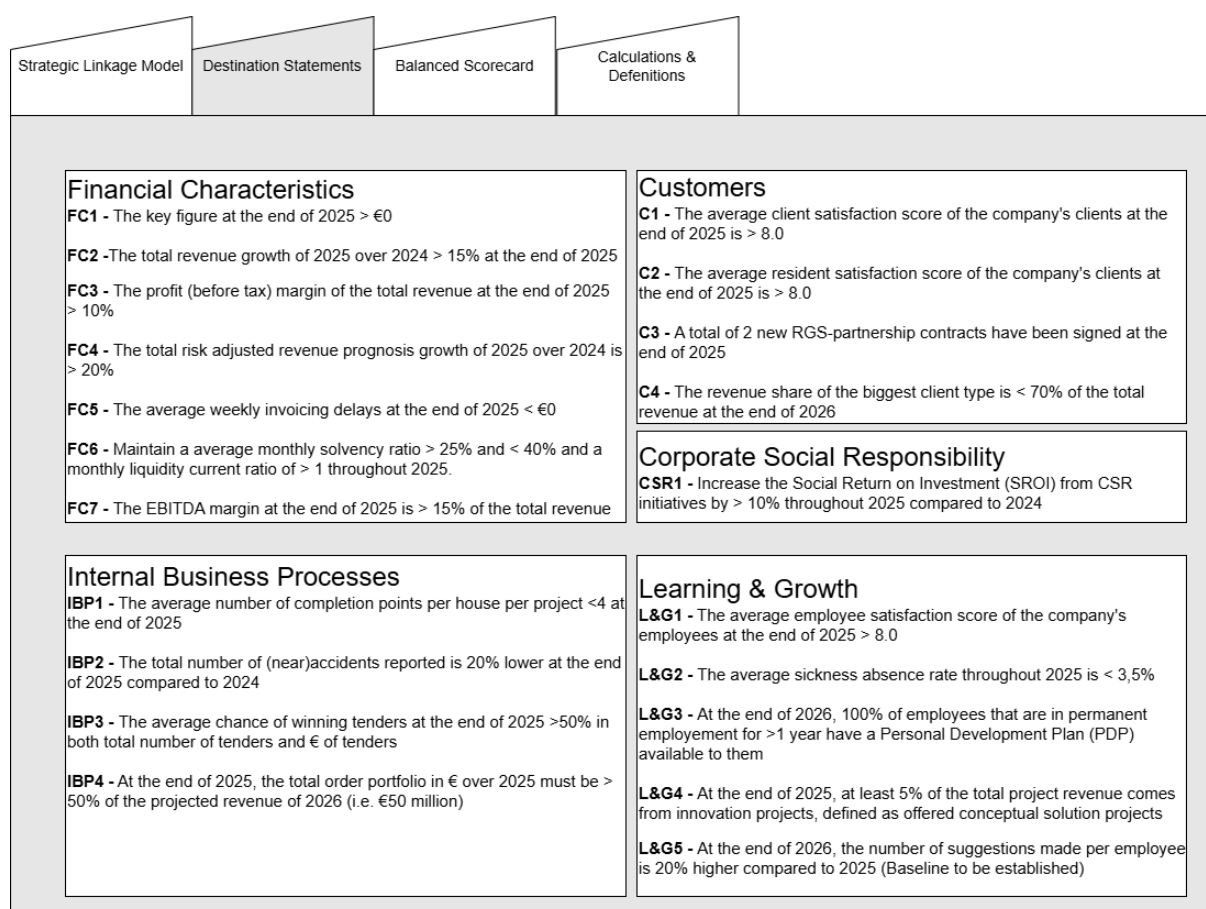


Note. Own work

Destination statements

Firstly, the new destination statements for innovative projects and suggestions per employee are developed using a clear time horizon and approved target (*e.g.*, **L&G4**, **L&G5**). Secondly, the redundant destination statement regarding work type revenue is removed from the figure. Checks and adjustments to the destination statements make sure that every statement clearly defines if performances should be met throughout the year, have an average score at the end of the year, or should have a specific score at the end of the year. Next, although no weights are assigned to destination statements, the order of destination statements is changed based on the priority of the performances on the strategy execution. Destination statements are ordered from the highest priority to the lowest priority. Lastly, an absolute value is added to statement **IBP4**. The final destination statements are reported in Figure 22.

Figure 22: Final Destination Statement design



Note. Own work

Balanced Scorecard

Firstly, labels such as **L&G3** for the third learning and growth perspective, link the destination statements with the right Balanced Scorecard objectives, metrics, measures, and targets. The new innovation and suggestion objectives are added to the design. Also, the new prioritized order of objectives from the destination statements is applied in the scorecard.

The red and green colors indicate missed/off-target indicators and achieved targets. These are applied to the scorecard, leaving room for targets without a sign when they are not yet at the end of the target deadline or when they are on track. Furthermore, tabs have been applied, making it easy to switch between the elements of the Balanced Scorecard.

Time frames that are redundant and are already in the destination statements have been removed, unless the time was part of the metric, for instance, a share of revenue compared to the projected revenue of 2026.

Although multiple objectives were considered, such as objectives for 2025 and 2026 in the scorecard, the current adjustability possibilities make sure that applying multiple objectives is not necessary. Therefore, it prevents the disturbance of the clear and calm appearance of the scorecard by adding another column of measures.

As objectives and targets are adjustable, initiatives can also be changed throughout the year, with possibilities to check off executed actions or initiatives linked to perspectives or objectives.

Figure 23 illustrates the final design of the Balanced Scorecard, incorporating the changes.

Figure 23: Final Balanced Scorecard design

Strategic Linkage Model		Destination Statements	Balanced Scorecard	Calculations & Definitions		
	Objective		Metric	Measure	Target	Initiatives
Financial	FC1	Meet overall financial target	The key figure in (€)	€ -125.000,-	> €0,-	• Introduce revenue prognosis document to 2 new subsidiaries
	FC2	Grow total revenue	The total revenue growth of 2025 over 2024 (%)	>7%	> 15%	
	FC3	Increase profitability	The profit of the total revenue (%)	10,83%	> 10,0%	
	FC4	Achieve revenue prognosis growth	risk adjusted revenue prognosis growth (%)	10%	> 20,0%	• Develop pre- and post-calculation profit margins for projects
	FC5	Maintain positive invoicing position	Average weekly invoicing delays (€)	€ - 21.385,-	< €0,-	• Implement financial dashboard
	FC6	Sustain financial health	Average monthly solvency ratio (%) Average monthly liquidity current ratio	35% 1,6	> 25% - < 40% > 1,0	• Initiative 4
	FC7	Improve EBITDA margin	EBITDA margin (%) of the total revenue	16%	> 15%	
Customer	C1	Maintain & improve client satisfaction	Average client satisfaction score per client	8.2	> 8.0	• Introduce interim and final project evaluations with all clients ✓
	C2	Maintain & improve resident satisfaction	Average resident satisfaction score per client	8.1	> 8.0	• Update satisfaction surveys
	C3	Expand long-term partnerships with clients, suppliers & co-makers	Newly signed RGS partnership contracts (#)	3	=>2	
	C4	Broaden share of activities across client types	Revenue share of biggest client type in total revenue (%)	85%	< 70%	• Initiative 3
Internal Business Process	IBP1	Ensure timely & high quality completion of projects	Average completion points per house per project (#)	3,7	< 4	• Set up Quality, Health & Safety, and Environment dashboard ✓ • Develop CRM tender management dashboard for prioritization • Initiative 3
	IBP2	Improve safety & health performance on works	Annual (near) accident reports (#)	3	< 10	
	IBP3	Strengthen tender management processes	Average chance of winning (# & €) tenders (%)	35%	>50%	
	IBP4	Expand order portfolio	Order portfolio share of 2026 projected revenue (%)	40%	>50%	
Learning & Growth	L&G1	Improving & maintaining employee satisfaction	Average employee satisfaction score	8,1	> 8.0	• Conduct annual employee satisfaction survey ✓ • Set up and implement suggestion box in employee app • Set up innovation speed-dates with competitors and subcontractors • Initiative 4
	L&G2	Reducing absenteeism	Average weekly sickness absence rate (%)	2,4%	< 3,5%	
	L&G3	Stimulate growth through Personal Development Plans (PDP)	Employees in permanent employment for > 1 year having a PDP	45%	100%	
	L&G4	Grow revenue share from innovation projects	Revenue share of innovation projects in total project revenue (%)	0,06%	> 5%	
	L&G5	Improve innovation climate through employee suggestions	Suggestions made per employee growth (%)	5%	> 20%	
CSR	CSR1	Increase Social Return on Investment (SROI) through CSR initiatives	SROI ratio growth (%)	11%	< 10%	• Initiative 1

Note. Own work: Measures and initiatives use fictitious data to represent the value in use

Calculations and Definitions

A fourth tab named 'Calculations & Definitions' with tables consisting of the calculations, data sources, data objects, and data points has been designed to secure the total scorecard and its data. A tabular report of these calculations and definitions is provided in Figure 24.

Figure 24: Final Calculations & Definitions design

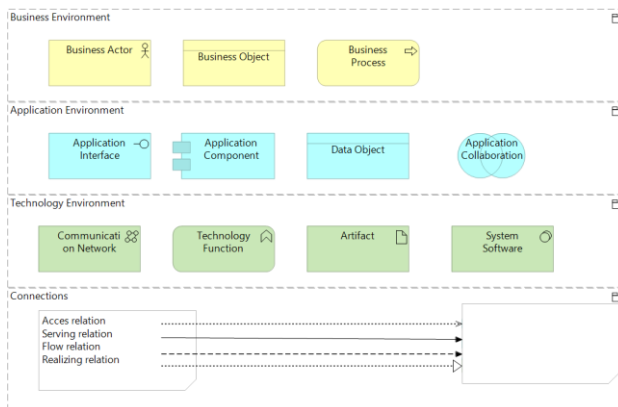
Strategic Linkage Model		Destination Statements	Balanced Scorecard	Calculations & Definitions		
	Objective		Metric & Calculation	Data Source	Data Object	Data points
Financial	FC1	Meet overall financial target	The key figure in (€) = <i>Key figure</i> in €	Craftview Gilde (ERP & CRM application)	ERP data - Financial/Offer data	<ul style="list-style-type: none">Weekly key-figure in €
	FC2	Grow total revenue	The total revenue growth of 2025 over 2024 (%) = $((\text{€revenue 2025} / \text{€revenue 2024}) * 100\%) - 100\%$	Craftview Gilde (ERP & CRM application)	ERP data - Financial/Offer data	<ul style="list-style-type: none">Total revenue over 2024 in €Total revenue over 2025 in €
	FC3	Increase profitability	The profit of the total revenue (%) = $\text{€profit (before tax)} / \text{€ total revenue} * 100\%$	Craftview Gilde (ERP & CRM application)	ERP data - Financial/Offer data	<ul style="list-style-type: none">Profit (before tax) in €Total revenue over 2025 in €
	FC4	Achieve revenue prognosis growth	risk adjusted revenue prognosis growth (%) = $(\text{€revenue prognosis 2025} / \text{€revenue prognosis 2024}) * 100\% - 100\%$	MS Excel Craftview Gilde ERP & CRM	Prognosis data	<ul style="list-style-type: none">Risk adjusted revenue prognosis 2024 in €Revenue prognosis 2025 in €
	FC5	Maintain positive invoicing position	Average weekly invoicing delays (€) = $\text{€summed weekly invoicing delays} / \text{weeks}$	Windream BPM (Invoicing)	Invoice data	<ul style="list-style-type: none">Summed weekly invoicing delays in €#weeks
	FC6	Sustain financial health	Average monthly solvency ratio (%) = $(\text{€total equity} / \text{€total assets}) * 100\%$ Average monthly liquidity current ratio = $(\text{€total current assets} / \text{€total current liabilities})$	Craftview Gilde (ERP & CRM application)	ERP data - Financial/Offer data	<ul style="list-style-type: none">Total Equity in €Total Assets in €Total Current assets in €Total current liabilities in €
	FC7	Improve EBITDA margin	EBITDA margin (%) of the total revenue = $\text{€EBITDA} / \text{€total revenue} * 100\%$	Craftview Gilde (ERP & CRM application)	ERP data - Financial/Offer data	<ul style="list-style-type: none">Total revenue in €EBITDA in €
Customer	C1	Maintain & improve client satisfaction	Average client satisfaction score per client = $\text{Summed scores client} / \text{satisfaction themes} / \text{survey replies}$	MoreApp (Forms)	Forms data - Satisfaction survey data	<ul style="list-style-type: none">Summed score client#satisfaction themes#survey replies
	C2	Maintain & improve resident satisfaction	Average resident satisfaction score per client = $\text{summed scores residents} / \text{satisfaction themes} / \text{survey replies}$	MoreApp (Forms)	Forms data - Satisfaction survey data	<ul style="list-style-type: none">Summed scores residents#satisfaction themes#survey replies
	C3	Expand long-term partnerships with clients, suppliers & co-makers	Newly signed RGS partnership contracts (#) = $\text{registered RGS partnerships 2025} - \text{registered RGS partnerships 2020-2024}$	VastWare (Long-term property management)	RGS-partnership data	<ul style="list-style-type: none">#RGS partnerships registered 2025#RGS partnerships 2020-2024
	C4	Broaden share of activities across client types	Revenue share of biggest client type in total revenue (%) = $(\text{€revenue biggest client type} / \text{€revenue all client types}) * 100\%$	Craftview Gilde (ERP & CRM)	ERP data - Financial/Offer data	<ul style="list-style-type: none">Client typesTotal revenue in €Revenue biggest client type in €
Internal Business Process	IBP1	Ensure timely & high quality completion of projects	Average completion points per house per project (#) = $\text{Total completion points} / \text{total projects} / \text{total houses per project}$	MoreApp (Forms application)	Forms data - Inspection/completion data	<ul style="list-style-type: none">Summed score employees#satisfaction themes#survey replies
	IBP2	Improve safety & health performance on works	Annual (near) accident reports (#) = $(\text{near accident reports 2025} / \text{near accident reports 2024}) * 100\% - 100\%$	MoreApp (Forms application)	Forms data - Quality, Health & Safety, Environment data	<ul style="list-style-type: none">#(near)accident reports 2024#(near)accident reports 2025
	IBP3	Strengthen tender management processes	Average chance of winning tenders (%) = $(\text{€won tenders} / \text{€calculated tenders}) * 100\%$	Craftview Gilde (ERP & CRM application)	ERP data - Financial/Offer data	<ul style="list-style-type: none">Tender or one-on-one project type# and € tender projects calculated# and € tender projects won
	IBP4	Expand order portfolio	Order portfolio share of 2026 projected revenue (%) = $\text{€total order portfolio} / \text{€projected annual revenue 2026} * 100\%$	Craftview Gilde (ERP & CRM) application	ERP data - Financial/Offer data	<ul style="list-style-type: none">Total order portfolio in €Projected annual revenue in €
Learning & Growth	L&G1	Improving & maintaining employee satisfaction	Average employee satisfaction score = $\text{summed score all employees} / \text{satisfaction themes} / \text{survey replies}$	MoreApp (Forms application)	Forms data - Satisfaction survey data	<ul style="list-style-type: none">Summed score employees#satisfaction themes#survey replies
	L&G2	Reducing absenteeism	Average weekly sickness absence rate (%) = $\text{Summed weekly sickness absence rate} / \text{weeks}$	CBBS - HR-Online (HRM application)	Employee data	<ul style="list-style-type: none">Weekly sickness absence rate#weeks
	L&G3	Stimulate growth through Personal Development Plans (PDP)	PDPs per permanent employees (%) = $\text{PDPs of permanent employees} / \text{employees in permanent employment}$	CBBS - HR-Online (HRM application)	Employee data	<ul style="list-style-type: none">#PDPs permanent employees#employees in permanent employment > 1 year
	L&G4	Grow revenue share from innovation projects	Revenue share of innovation projects in total project revenue (%) = $\text{€innovation project revenue} / \text{€total project revenue}$	Craftview Gilde (ERP & CRM application)	ERP data - Project data	<ul style="list-style-type: none">€innovation project revenue€total project revenue
	L&G5	Improve innovation climate through employee suggestions	Suggestions made per employee growth (%) = $((\text{#suggestions 2026} / \text{#employees 2026}) / (\text{#suggestions 2025} / \text{#employees 2025})) * 100\% - 100\%$	MoreApp (Forms application)	Forms data - Quality, Health & Safety, Environment data	<ul style="list-style-type: none">#Suggestions submitted 2025#Suggestions submitted 2026#employees 2025#employees 2026
CSR	CSR1	Increase Social Return on Investment (SROI) through CSR initiatives	SROI ratio growth (%) = $((\text{SROI ratio 2025} / \text{SROI ratio 2024}) * 100\%) - 100\%$	Craftview Gilde (ERP & CRM application)	ERP data - Project data ERP data - Client/customer	<ul style="list-style-type: none">SROI ratio 2024SROI ratio 2025

Note. Own work

Business Intelligence & Analytics architecture

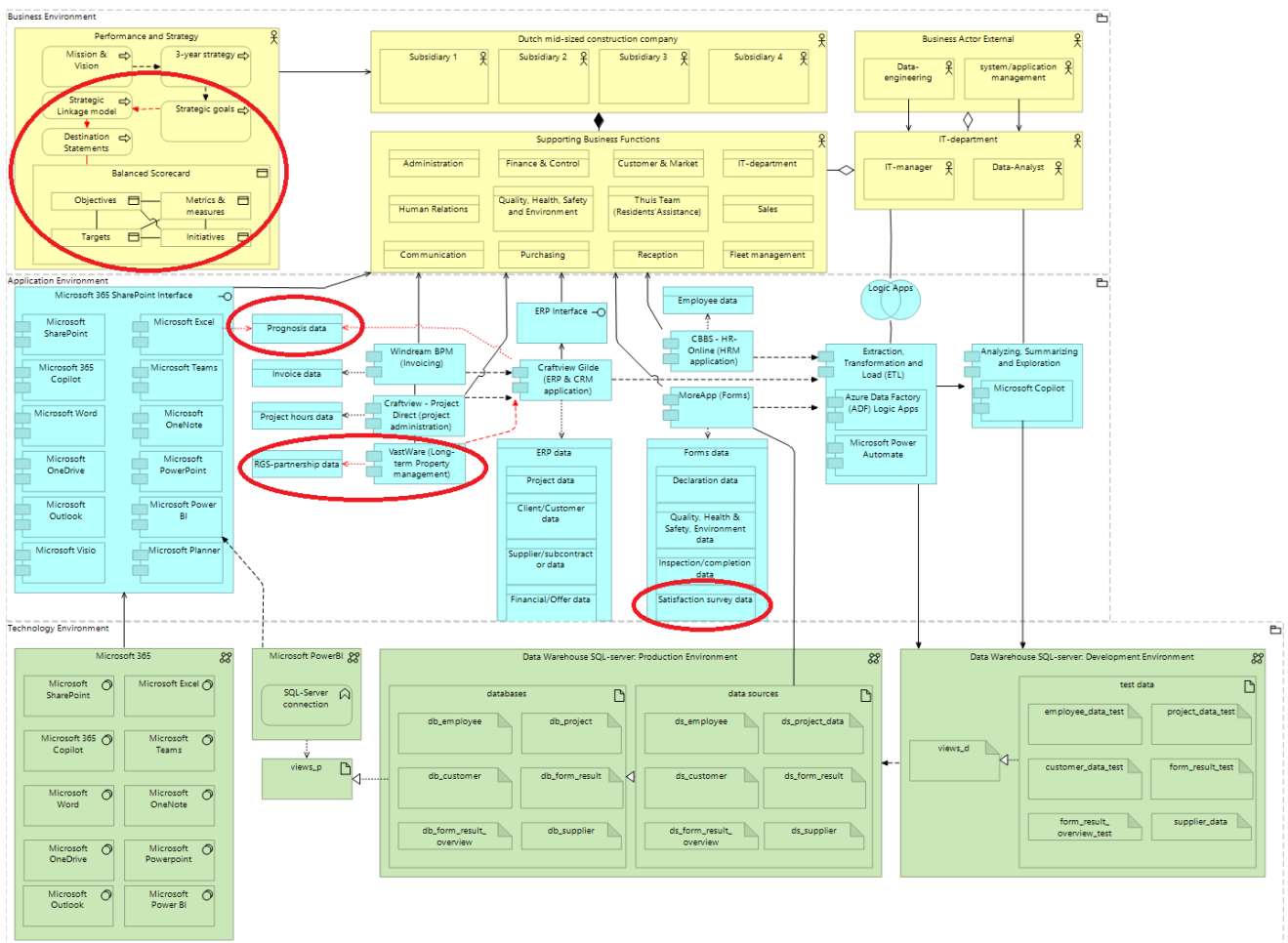
For the BI&A design, a specific BI&A legend is developed, helping with the readability of the diagram. Changes to the design to make the connections or objects clearer than before did not receive any improved architecture diagram. As the new indicators use existing data sources and objects (*ERP data & Forms data*), no new connections, databases, or views are required in the warehouse and analytics environment. Figure 25 displays the newly developed BI&A architecture legend, together with the final BI&A architecture, visualized in Figure 26.

Figure 25: ArchiMate Legend



Note. Own work.

Figure 26: Final Business Intelligence & Analytics design

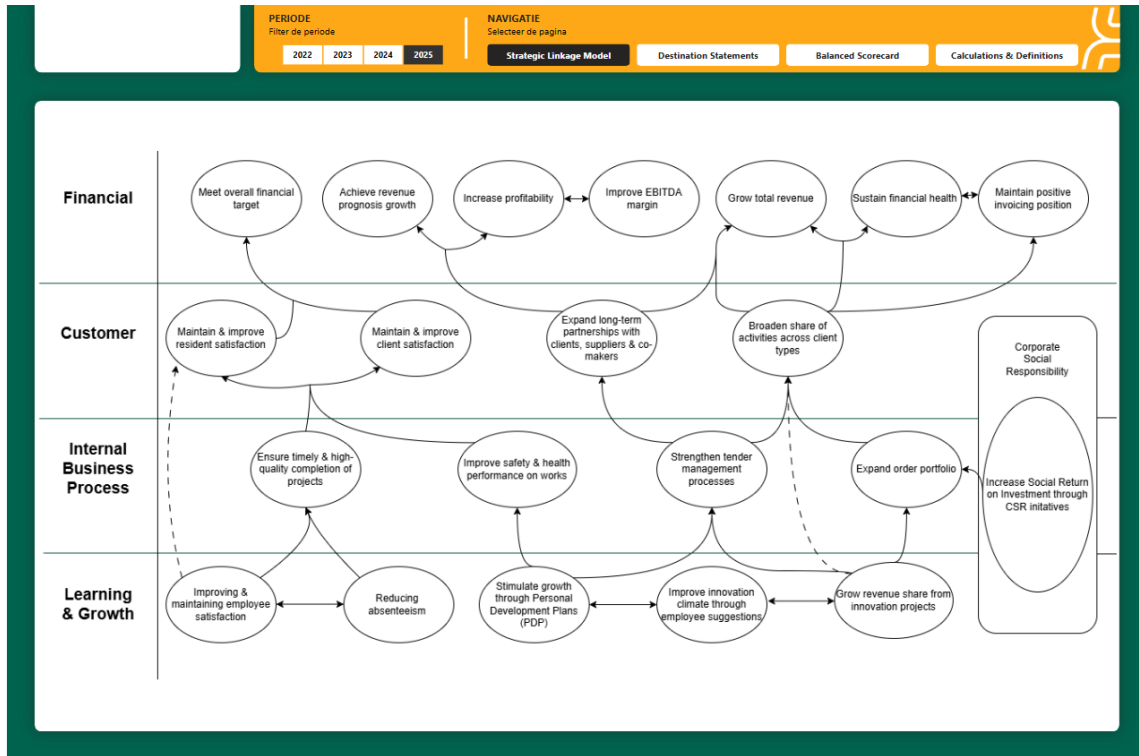


Note. Own work

Final implemented design

In addition to the previous designs, a final implemented design has been developed, showing the four cooperating tabs in a Power BI environment in Figures 27, 28, 29, and Figure 30.

Figure 27: Final Strategic Linkage model



Note. Own work

Figure 28: Final Destination Statements

PERIODE Filter de periode		NAVIGATIE Selecteer de pagina	
2022	2023	2024	2025
Strategic Linkage Model		Destination Statements	Balanced Scorecard
		Calculations & Definitions	

FINANCIAL CHARACTERISTICS Versie 2025	
Onderwerp	Destination statement
FC1	The key figure at the end of 2025 > €0
FC2	The total revenue growth of 2025 over 2024 > 15% at the end of 2025
FC3	The profit (before tax) margin of the total revenue at the end of 2025 > 10%
FC4	The total risk adjusted revenue prognosis growth of 2025 over 2024 is > 20%
FC5	The average weekly Invoicing delays at the end of 2025 < €0
FC6	Maintain a average monthly solvency ratio > 25% and < 40% and a monthly liquidity current ratio of > 1 throughout 2025.
FC7	The EBITDA margin at the end of 2025 is > 15% of the total revenue

CUSTOMERS Versie 2025	
Onderwerp	Destination statement
C1	The average client satisfaction score of the company's clients at the end of 2025 is > 8.0
C2	The average resident satisfaction score of the company's clients at the end of 2025 is > 8.0
C3	A total of 2 new RIGS-partnership contracts have been signed at the end of 2025
C4	The revenue share of the biggest client type is < 70% of the total revenue at the end of 2026

INTERNAL BUSINESS PROCESSES Versie 2025	
Onderwerp	Destination statement
IBP1	The average number of completion points per house per project < 4 at the end of 2025
IBP2	The total number of (near)accidents reported is 20% lower at the end of 2025 compared to 2024
IBP3	The average chance of winning tenders at the end of 2025 > 50% in both total number of tenders and € of tenders
IBP4	At the end of 2025, the total order portfolio in € over 2025 must be > 50% of the projected revenue of 2026 (i.e. €50 million)

LEARNING & GROWTH Versie 2025	
Onderwerp	Destination statement
L&G1	The average employee satisfaction score of the company's employees at the end of 2025 > 8.0
L&G2	The average weekly sickness absence rate throughout 2025 is < 3.5%
L&G3	At the end of 2026, 100% of employees that are in permanent employment for > 1 year have a Personal Development Plan (PDP) available to them
L&G4	At the end of 2025, at least 5% of the total project revenue comes from innovation projects, defined as offered conceptual solution projects
L&G5	At the end of 2026, the number of suggestions made per employee is 20% higher compared to 2025 (baseline to be established)

CORPORATE SOCIAL RESPONSIBILITY Versie 2025	
Onderwerp	Destination statement
CSR1	Increase the Social Return on Investment (SROI) from CSR initiatives by > 10% throughout 2025 compared to 2024

Note. Own work

Figure 29: Balanced Scorecard final implemented design

PERIODE Filter de periode					
2022 2023 2024 2025					
NAVIGATIE Selecteer de pagina					
Strategic Linkage Model Destination Statements Balanced Scorecard Calculations & Definitions					
BALANCED SCORECARD Versie juni 2025					
Onderwerp	Objective	Metric	Measure	Target	
Financieel					
FC1	Meet overall financial target	The key figure in (€)	€ -125.000,-	> €0,-	Implement finan
FC2	Grow total revenue	The total revenue growth of 2025 over 2024 (%)	>7%	> 15%	Initiative 2
FC3	Increase profitability	The profit of the total revenue (%)	10,83%	> 10,0%	Develop pre- an
FC4	Achieve revenue prognosis growth	risk adjusted revenue prognosis growth (%)	10%	> 20,0%	Introduce reveni
FC5	Maintain positive invoicing position	Average weekly invoicing delays (€)	€ - 21.385,-	< €0,-	Initiative 5
FC6-1	Sustain financial health	Average monthly solvency ratio (%)	30%	> 25% - < 40%	Initiative 6
FC6-2	Sustain financial health	Average monthly liquidity current ratio	1,6	> 1,0	Initiative 7
FC7	Improve EBITDA margin	EBITDA margin (%) of the total revenue	16%	> 15%	Initiative 8
Customer					
C1	Maintain & improve client satisfaction	Average client satisfaction score per client	8,2	> 8,0	Introduce interir
C2	Maintain & improve resident satisfaction	Average resident satisfaction score per client	8,1	> 8,0	Update satisfact
C3	Expand long-term partnerships with clients, suppliers & co-makers	Newly signed RGS partnership contracts (#)	3	=>2	Initiative 11
C4	Broaden share of activities across client types	Revenue share of biggest client type in total revenue (%)	85%	< 70%	Initiative 12
Internal Business Process					
IBP1	Ensure timely & high quality completion of projects	Average completion points per house per project (#)	3,7	< 4	Initiative 13
IBP2	Improve safety & health performance on works	Annual (near) accident reports (#)	3	< 10	Set up Quality, f
IBP3	Strengthen tender management processes	Average chance of winning (# & €) tenders (%)	35%	>50%	Develop CRM te
IBP4	Expand order portfolio	Order portfolio share of 2026 projected revenue (%)	40%	>50%	Initiative 16
Learning & Growth					
L&G1	Improving & maintaining employee satisfaction	Average employee satisfaction score	8,1	> 8,0	Conduct annual
L&G2	Reducing absenteeism	Average sickness absence rate (%)	2,40%	< 3,5%	Initiative 18
L&G3	Stimulate growth through Personal Development Plans (PDP)	Employees in permanent employment for > 1 year having a PDP	45%	100%	Initiative 19
L&G4	Grow revenue share from innovation projects	Revenue share of innovation projects in total project revenue (%)	0,06%	> 5%	Set up innovatio
L&G5	Improve innovation climate through employee suggestions	Suggestions made per employee growth (%)	5%	> 20%	Set up and impli
CSR					
CSR1	Increase Social Return on Investment (SROI) through CSR Initiatives	SROI ratio growth (%)	11%	< 10%	Initiative 21

Note. Own work: Measures and initiatives use fictitious data to represent the value in use

Figure 30: Final Calculations & Definitions

PERIODE Filter de periode					
2022 2023 2024 2025					
NAVIGATIE Selecteer de pagina					
Strategic Linkage Model Destination Statements Balanced Scorecard Calculations & Definitions					
BALANCED SCORECARD Versie juni 2025					
Onderwerp	Data Source	Data Object	Data Points	Calculation	
Financieel					
FC1	Craftview Gilde	ERP data - Financial/Offer data	Weekly key-figure in €	Key figure in €	The key figure in (€)
FC2	Craftview Gilde	ERP data - Financial/Offer data	Total revenue over 2025 in €	$((\text{€revenue 2025} / \text{€revenue 2024}) * 100\%) - 100\%$	The total revenue grow
FC3	Craftview Gilde	ERP data - Financial/Offer data	Total revenue over 2025 in €	$(\text{€profit (before tax)} / \text{€total revenue}) * 100\%$	The profit of the total n
FC4	Craftview Gilde	Prognosis data	Risk adjusted revenue prognosis 2024 in €	$(\text{€revenue prognosis 2025} / \text{€revenue prognosis 2024}) * 100\% - 100\%$	risk adjusted revenue p
FC5	Windream BPM	Invoice data	Summed weekly invoicing delays in €	$(\text{€summed weekly invoicing delays} / \text{weeks})$	Average weekly invoic
FC6-1	Craftview Gilde	ERP data - Financial/Offer data	Total Equity in €	$(\text{€total equity} / \text{€total assets}) * 100\%$	Average monthly solv
FC6-2	Craftview Gilde	ERP data - Financial/Offer data	Total Current liabilities in €	$(\text{€total current assets} / \text{€total current liabilities})$	Average monthly liqui
FC7	Craftview Gilde	ERP data - Financial/Offer data	Total revenue in €	$(\text{€EBITDA} / \text{€total revenue}) * 100\%$	EBITDA margin (%) of t
Customer					
C1	MoreApp	Forms data - Satisfaction survey data	Summed score client	$(\text{summed scores client} / \text{satisfaction themes} / \text{survey replies})$	Average client satisfact
C2	MoreApp	Forms data - Satisfaction survey data	Summed scores residents	$(\text{summed scores residents} / \text{satisfaction themes} / \text{survey replies})$	Average resident satisfi
C3	VastWare	RGS-partnership data	#RGS partnerships registered 2025	$(\text{registered RGS partnerships 2025} - \text{registered RGS partnerships 2020-2024})$	Newly signed RGS part
C4	Craftview Gilde	ERP data - Financial/Offer data	Total revenue in €	$(\text{€revenue biggest client type} / \text{€revenue all client types}) * 100\%$	Revenue share of bigge
Internal Business Process					
IBP1	MoreApp	Forms data - Inspection/completion data	Summed score employees	$(\text{Total completion points} / \text{total projects} / \text{total houses per project})$	Average completion pc
IBP2	MoreApp	Forms data - Quality, Health & Safety, Environment data	#(near)accident reports 2025	$((\text{near} / \text{accident reports 2025} / \text{(near)accident reports 2024}) * 100\%) - 100\%$	Annual (near) accident
IBP3	Craftview Gilde	ERP data - Financial/Offer data	Tender or one-on-one project type	$(\text{€won tenders} / \text{€calculated tenders}) + (\text{€won tenders} / \text{€calculated tenders}) / 2$	Average chance of win
IBP4	Craftview Gilde	ERP data - Financial/Offer data	Total order portfolio in €	$(\text{€total order portfolio} / \text{€projected annual revenue 2026}) * 100\%$	Order portfolio share o
Learning & Growth					
L&G1	MoreApp	Forms data - Satisfaction survey data	Summed score employees	$(\text{summed score all employees} / \text{satisfaction themes} / \text{survey replies})$	Average employee sati
L&G2	CBBS HR-Online	Employee data	Weekly sickness absence rate	$(\text{Summed weekly sickness absence rate} / \text{weeks})$	Average weekly sicknes
L&G3	CBBS HR-Online	Employee data	#PDPs permanent employees	$(\text{PDPs of permanent employees} / \text{employees in permanent employment})$	Employees in perman
L&G4	Craftview Gilde	ERP data - Project data	€total project revenue	$(\text{€innovation project revenue} / \text{€total project revenue})$	Revenue share of innov
L&G5	MoreApp	Forms data - Quality, Health & Safety, Environment data	#Suggestions submitted 2026	$((\text{#suggestions 2026} / \text{#employees 2026}) / (\text{#suggestions 2025} / \text{#employees 2025}) * 100\%) - 100\%$	Suggestions made per
CSR					
CSR1	Craftview Gilde	ERP data - Client/customer data	SROI ratio 2025	$((\text{SROI ratio 2025} / \text{SROI ratio 2024} * 100\%) - 100\%)$	SROI ratio growth (%)

Note. Own work

4.5.3 Final design evaluation

To evaluate and validate the final design, the design will be compared and checked based on the final specifications and Balanced Scorecard characteristics and limitations.

The final design of the Balanced Scorecard shows a balance in perspectives, representing financial and non-financial objectives, short- and long-term perspectives, external and internal-oriented performance measures, and lagging and leading indicators. The 21 objectives in the scorecard ensure a clear tabular view of performance measurements, which is broad enough to capture the overall performance of the strategy execution. The balance in stakeholder interests is further extended based on the addition of a CSR perspective focusing on the performances of the social and environmental stakeholders. The inclusion of an innovation and a learning climate indicator in the final design addresses the imbalance in leading and lagging indicators. On the other hand, the seven out of 21 objectives representing the financial perspective emphasize the continuing importance of financial control within the company.

The Balanced Scorecard is derived from the company-wide current three-year strategic term (2023-2026) and based on lead users, company documents, strategic experts, and relevant literature. This ensures a Balanced Scorecard tailored to the industry and context of the company using different viewpoints. Annual objectives are set following the financial reporting year, can be adjusted, and contain an active initiative list, enabling flexibility in the scorecard. This dynamic Balanced Scorecard can adapt to fast changing environments and strategies, which fits the company's focus.

The four tabs of the Balanced Scorecard ensure clear visual, textual, and statistical justification and support for the Balanced Scorecard contents and BI&A architecture changes. Not only causal, but also logical relationships are drawn in the strategic linkage model, showing coherence and relationships. Destination statements ensure quantifiable objectives with clear time goals. Also, with the Calculations and Definitions tab, the underlying processes of the Balanced Scorecard design are secured.

The applied indicators, metrics, and targets are as much based on existing sources as possible, preventing the selection or generation of new indicators that lack a successful measurement of the intended indicator. Considerations have been taken regarding the influenceability, decomposability, non-redundancy, and completeness of the objectives, metrics, and targets.

Although specified, the application of 'unique' objectives for subsidiaries is not executed, as no subsidiary strategy or vision was available within the company. This highlights the short-term and financial orientation of the construction company and its subsidiaries, limiting further applications.

The supporting BI&A architecture with matching legend shows that the current Data Warehouse layout provides an effective integration and implementation of new data sources. Connections of new data sources flow to existing applications so that ETL tools can easily connect to access the data. Consequently, no new connections between the ETL tools and new applications are needed. This emphasizes the accessibility and availability of data based on the warehouse layout. The inclusion of the new data sources into the data warehouse layout enables them to participate in the automated workflows, refreshment cycles, and analytics processes. The Business Analytics environment for the Balanced Scorecard is restricted to descriptive analytics, reporting past and current data through statistics and calculations with a corresponding time perspective applied to it. The user interface overlaps with the final layout design of the Balanced Scorecard. Restricted access to managers and the members of the boards can be implemented based on roles for accessing, editing, and reading the Power BI report.

Overall, Phase 5 identified final specifications based on evaluations and feedback to the prototype design. A final design is reached, based on these final specifications, completing the design research process and delivering a definitive design.

5 Discussion

This section describes the main results and findings of the design research process, answering the question: *How can a balanced performance measurement system be applied in a Dutch construction company using Business Intelligence and Analytics systems to enhance performance management?* The findings and results are interpreted and compared with the existing literature and theories. Then, the corresponding implications for theory and practice will be discussed. After which, the limitations of the research are addressed and how they impact the results. Finally, recommendations for future research will be made to extend theory.

5.1 Discussion and analysis

This research focuses on applying the Balanced Scorecard to a Dutch construction company, using Business Intelligence and Analytics systems to enhance performance measurement.

Balanced Scorecard application

Looking at the Balanced Scorecard application in general, the design process outcomes indicate that, as Ahn (2001) argued, the Balanced Scorecard is, at its core, a guiding framework rather than a completely developed performance measurement system. Results confirm that Balanced Scorecard theories and literature provide limited insights into strengths and weaknesses and that the real value of the scorecard emerges after the application of practical cases (Ahn, 2001; Mooraj et al., 1999).

It was found that the third-generation Balanced Scorecard by Lawrie and Cobbold (2004), consisting of a strategic linkage model, destination statements, and the scorecard, substantially simplified the design process. The strategic linkage model with cause-effect and logical relationships facilitated justification for indicator selection processes, while clarifying strategy communication (Norreklit, 2000; Olve et al., 2001). The destination statements further enhanced the strategic focus. Results indicate that the design of destination statements functioned as additional support for the scorecard. Specifically, designing quantifiable targets with a fixed future time period supported making SMART (Specific, Measurable, Attainable, Relevant, Time-based) objectives (Lawrie & Cobbold, 2004).

Consequently, the design process of the actual Balanced Scorecard was simplified by incorporating elements from the strategic linkage model and the destination statements as objectives, metrics, measures, and targets could be directly derived from them. This emphasizes the structured objective and target-setting approach characterizing performance measurement systems (Simons et al., 2000).

The design process departs from Lawrie and Cobbold (2004), arguing to first design the destination statement before mapping out the strategic objectives in a linkage model. Findings of the design process show that designing the strategic linkage model first provides where the organization wants to go to, through objectives, and then how these objectives interrelate. Next, destination statements show what success should look like for these objectives in the future, attaching targets. This method proved to be successful in this case.

The results also challenge the feature of the ‘scorecard’ itself as a single-screen view evaluating organizational performances, as intended by Kaplan and Norton (1996). The final scorecard design, on its own, has no value without the strategic linkage model and the destination statements. The combination of these three documents together is essential in evaluating strategy execution performances. This goes against the Balanced Scorecard core principles of a simple, quick report summarizing strategic performances in a single-screen view suggested by Kaplan and Norton (1992).

On top of that, findings suggest the need for an additional fourth Balanced Scorecard element: a calculation & definition table describing formulas, data sources, and data objects in detail,

safeguarding consistency and improving transparency regarding data. This need is a consequence of integrating the Business Intelligence and Analytics environments with the Balanced Scorecard.

For that reason, the findings indicate that the principle of the Balanced Scorecard being a single-screen view should be revised, as the total Balanced Scorecard requires multi-layered views for optimal strategy execution, performance measurement, and the safeguarding of the underlying processes.

The process of involving different levels of stakeholders in setting business needs resulted in broad insights into specifications for the Balanced Scorecard, responding to concerns of the limited stakeholder inclusion in the design process by Tawse and Tabesh (2023). By interviewing strategy experts, subsidiary leaders, and perspective-specific experts, insights from the strategic, tactical/operational, and functional levels were gathered collectively. The broad selection of different levels is based on the lead user method by Ulrich and Eppinger (2016). The specification, prototype, and final design phases use strategy experts while considering equal stakeholder interests. This follows Kaplan and Norton (1996) and later Lawrie and Cobbold (2004), emphasizing the responsibility and expertise of the senior management in translating the strategy into the Balanced Scorecard.

The data triangulation of business needs, current characteristics, and literature in the identification and specification process of indicators enhanced completeness and strategy translation efforts by integrating practice and theory. Thus, addressing applicability concerns by Hoque (2014). The results of the business needs and specifications phases regarding the Balanced Scorecard generated criteria for metric and measurement determination. These criteria proved to be strongly related to controllability, decomposability, non-redundancy, and completeness as important criteria for successful Balanced Scorecard implementation in practice (Ahn, 2001; Keeney & Raiffa, 1993; Lipe & Salterio, 2000).

Focusing on the specific goal of the Balanced Scorecard, evaluating organizational performance through four separate perspectives (Kaplan & Norton, 1992). Throughout the design process, adjustments to the design improved the balance between the original four perspectives, as the initial design was aimed too much at short-term, lagging indicators, and the financial perspective. The final design, having a total of 21 objectives and at least four objectives per original perspective, captured the 'balance' in financial and non-financial measures, short and long-term views, external and internal perspectives, and lagging and leading indicators as intended by Kaplan and Norton (1996).

Specific design considerations improve the adjustability of the scorecard, increasing the dynamic orientation and resilience to fast changing environments of the DVUCA world (Kumar et al., 2024). Although critics of the static layout remain valid, the design incorporating adjustable objectives, active initiative lists, and short-term indicators mitigates these limitations, improving flexibility (Aryani & Setiawan, 2020).

The results indicate that the original Balanced Scorecard design by Kaplan and Norton (1992) falls short in monitoring the performances of social and environmental stakeholders, as criticized by (Awadallah & Allam, 2015). The original perspectives did not capture this perspective, although it was a relevant strategic objective of the studied case. Following Brignall (2002), a focus on corporate social responsibility ensured that the Balanced Scorecard also monitored performances on social and environmental stakeholders. The design suggests corporate social responsibility as a fifth and independent perspective. The structured design process ensured the inclusion of a clear CSR performance indicator. The corporate social responsibility view was specifically not included in other perspectives as they focus on the actions and outcomes of the internal organization rather than the external environment and society. Furthermore, it was argued that CSR initiatives and outcomes influenced the learning and growth, internal business process, and customer perspectives simultaneously and should not be assigned to one of them.

Construction industry

The found lack of existing performance measurement systems, absence of centralized reporting, and focus on financial indicators underscores the lagging state of the performance measurement system adoption in the construction industry as stated by Dobrovič et al. (2018). The final design of the scorecard reveals that the financial dominance remains present. However, the importance and influenceability of non-financial indicators receives a growing attention through the Balanced Scorecard, improving the balance within performance measurement practices of the organization.

Also, the short-term orientation of the strategy, which could also be due to the company's size, resulted in an initial scorecard that lacked balance in short- and long-term objectives (Andersen et al., 2001). Both the financial dominance and short-term orientation within the company support Dubois and Gadde (2002), arguing the absence of a long-term strategic focus. This caused the design and collection of long-term and non-financial indicators to be less straightforward to apply to the case.

Lastly, as the subsidiaries have no separate strategies focused on their subsidiaries, they rely on the organizational strategy. Thus, a consolidated level of reporting is used. The absence of subsidiary strategies limits possibilities and needs to add 'unique' subsidiary objectives to the 'common' organizational strategic objectives, hindering scalability and applicability (Lipe & Salterio, 2000).

Role and value of BI&A in enhancing performance measurement

Capturing the BI&A architecture prior to the design phase demonstrated that the existing architectures are mainly focused on providing insights for specific business functions and projects, rather than overarching performance measurement of the company. This is also noted by Li et al. (2023) and Singh et al. (2024) in their research into data analytics and intelligence in the construction industry.

Business Intelligence and Analytics enhances performance measurement processes by enabling efficient implementation and integration processes of new data sources into the environment. The existing Business Intelligence and Analytics environment facilitated data availability through other business functions for the Balanced Scorecard implementation. This further provided integration into the standard analytics processes, while implementing new data objects was made more efficient. The centralized performance measurement system enables accessibility of performance measurement as a crucial business information source, improving in time informed decision-making (Chen et al., 2012)

The design process showed that the data warehouse layout ensured automated and standardized data collection and preparation processes for the scorecard. Furthermore, by securing detailed data objects in the definitions and calculation tab of the Balanced Scorecard, the underlying processes regarding data were captured in both the scorecard and architecture map. As a result, the design, supporting environments, and data sources are captured within the end product, delivering an integrated Balanced Scorecard.

Within the scorecard, the fixed tabular scorecard design and components limit the use of complex visualizations in the report, enabling clear single-screen views. The absence of advanced visualizations increased the functional focus on the multi-perspective view. Therefore, the accessible and easily implementable tabular design of the scorecard increases scalability and applicability in the broader industry. However, this graphical absence in the scorecard ignores the wide range of possibilities of the Business Analytics environment, such as revealing trends, extreme values, or underlying factors.

Furthermore, the descriptive orientation of the scorecard lacks the use of advanced Business Analytics techniques. On the one hand, the design of the scorecard takes this into account by balancing out leading and lagging indicators and short- and long-term indicators. On the other hand, the focus on describing or reporting past and current data ignores analytics techniques, resulting in informed predictions, future events, or recommended actions or decisions (Delen & Zolbanin, 2018). This also lacks including the increasing importance of Artificial Intelligence capabilities (Kumar et al., 2024).

5.2 Theoretical implications

This design research contributes to Balanced Scorecard and BI&A theories by integrating a performance measurement framework with intelligence and data analytics environments, which is an underexplored subject of research in the construction industry. By presenting benefits and exposing limitations of integrating the current Balanced Scorecard with the current capabilities and features of BI&A systems, integration evidence can be added to the literature of these theories. This also provides further evidence of the readiness and current BI&A adoption and practices in the construction industry.

Furthermore, this research validates the broad applicability of the Balanced Scorecard across industries as the structured design with its specifications of Balanced Scorecard theory is applied to a financial-driven, short-term-oriented construction industry. Therefore, this research extends performance measurement system application evidence in the construction industry by identifying gaps and further mapping out the translation from performance measurement theory into practice. This adds to the theory explaining how to translate strategic objectives into specific indicators and targets, addressing applicability concerns suggested by several researchers.

Applying the third-generation Balanced Scorecard frameworks broadens the continuing development of performance measurement theory. The design research not only confirms the effectiveness and efficiency of the use and application processes, but also extends theory with a destination and calculation tab as a reference and supporting Balanced Scorecard element. As a result, the integration of the Balanced Scorecard and BI&A enlarges the multi-layered view for strategy execution.

With the application evidence, this research also challenges the limitations and weaknesses of critical Balanced Scorecard reviews by presenting how they have been addressed in practice. This includes assessing the applicability of the Balanced Scorecard to the current rapidly changing environments.

This research further contributes to performance indicator theory in the construction industry by providing evidence of researching, identifying, and prioritizing key metrics and subjects used in the performance measurement of a construction company. Thus, broadening the body of knowledge of long-term and balanced performance management practices in the construction industry.

Lastly, this research adds to the design research application theory by having a transparent practical design method applicable and scalable to similar industries and companies, enabling scalability. Together, these contributions enhance the widespread adoption of Business Intelligence & Analytics and balanced Performance Measurement Systems in the construction industry.

5.3 Practical implications

This research delivers a step-by-step design method for implementing a Balanced Scorecard in mid-sized companies within the construction industry. Managers from similar organizations within the construction industry can replicate this design process and follow the transparent research phases to make the Balanced Scorecard tailored to their organization, which therefore serves as an example of a replicable design method.

The insights from design present a performance measurement report supported by Business Intelligence and Analytics systems enabling automated, transparent, and timely insights. Furthermore, the end design of the Balanced Scorecard is supported by an architecture mapping out the business, application, and technology environment regarding the Balanced Scorecard application.

On the performance measurement level, the application of the Balanced Scorecard ensures a balanced evaluation of strategy execution for the company, focusing on financial and non-financial indicators for the organization, providing a practical solution to industry-specific identified problems.

Lastly, the design process reveals practical bottlenecks, trade-offs, and key findings within the case, limiting or progressing the end design of the Balanced Scorecard and BI&A architecture. Managers can use the insights of the design process for their own application process, such as the list of Balanced Scorecard subjects as a source of information for objective, metric, and target selection.

5.4 Limitations and recommendations for future research

Although this design research delivered a Balanced Scorecard with corresponding BI&A architecture tailored to the company, some limitations affect the scope or results of the research. Also, future research suggestions will be made regarding the limitations or results of the research.

Starting, the single case study provides research to be done on one specific case with its own characteristics and context. As a result, evidence from one case does not provide the same evidence for other cases, as more evidence is needed to confirm and, therefore, make findings generalizable. The findings of this research should, therefore, be interpreted while taking this limitation into account. Future research could replicate the methodology and apply it to similar construction firms and collect common findings, trade-offs, drawbacks, and strengths of applying the Balanced Scorecard and BI&A in the construction industry, for instance, through a multiple case study.

Although literature is included in this research, the current specification and design process is mostly focused on internal sources, describing requirements and criteria for the prototype and final design. The inclusion of more external sources in the specification process could alter findings and results. Therefore, future research could focus on including external sources in the design process, as external experience, expertise, insights, and views could enhance needs and specification identification.

Another limitation is found in the validation of the end product that is being delivered to the company. Feedback for the prototype design is generated based on qualitative testing, feedback, and refining the design, which delivers final specifications. The final design, although based on these specifications, was not fully implemented in the case company at the time of writing. Thus, the design cycle was not fully completed; the final design focused on the application design process and not the entire implementation. As a result, the impact and performance of the final design in use cannot be validated.

Future research could focus on validating the use of the final Balanced Scorecard design after the implementation and use to measure the performance of the intended 'balance' in performance measurement. Also, the inclusion of quantitative validation criteria or frameworks could strengthen the evaluation process. Validation is therefore important in the short- and long-term adoption of the Balanced Scorecard to capture to what extent the integration of the Balanced Scorecard and BI&A systems enhances performance management over different time perspectives.

Moreover, the final product delivered is the result of the design process on a design level. However, the scope of the research did not touch on the implementation, use, and sustaining of the Balanced Scorecard in the performance measurement process of the company. The design is therefore limited to delivering the artifacts without focusing on how the Balanced Scorecard should be implemented and how the organization should manage this change from start to end. As a result, future research could focus on the process of implementation and use processes, for instance, by executing research from the change management perspective applying models such as Kotter's eight-step change model or Lewin's (*Unfreeze-Change-Refreeze*) change model to investigate this (Kotter, 2012; Schein, 1996).

Although the Balanced Scorecard requires descriptive analytics for a successful application of theory to practice, predictive and prescriptive analytics potential in estimating, predicting, and recommending future actions is largely ignored in the Balanced Scorecard. The growing importance of performance measurement systems and BI&A integration suggests that future research should focus on the use and

applicability of predictive and prescriptive analytics in performance measurement systems. Besides that, future research could focus on the upcoming automated reporting possibilities that Artificial Intelligence (AI) is bringing to performance measurement, which is currently largely ignored.

Lastly, design research has several methods to identify needs, specifications, and final designs. Future studies could focus on improving elements of these design research methods, testing the effectiveness of different data collection, analysis, and design methods and their influence on the final design of the Balanced Scorecard. This could improve future scalability and applicability of the design method.

6 Conclusion

This research focused on applying a balanced performance measurement system in a Dutch construction company, using Business Intelligence and Analytics systems to enhance performance management. A design research approach was used to ensure that a user-centered final design was delivered to the studied case depending on a transparent research process based on real-life evidence.

The Balanced Scorecard application process shows that the use of the third-generation Balanced Scorecard with the associated strategic linkage model and destination statements enhanced the strategic orientation, clarified relationships between strategic objectives, and simplified metric, measure, and target selection processes. The application of the Balanced Scorecard within the construction industry reveals industry-specific characteristics, trade-offs, drawbacks, and benefits, contributing to a design tailored to the construction industry, enabling scalability and replicability for similar companies. The findings also reveal how application theories, Balanced Scorecard deviations, and limitations are addressed for this case while aligning to key criteria of the case and theories.

The design process of integrating two theoretical frameworks – the BI&A architecture and the Balanced Scorecard – reveals practical evidence of application theories regarding both concepts. A clear design research process combined both internal and external sources for a well-supported design. This enhances the integration and applicability of data-driven performance management within the construction industry.

Furthermore, the research shows that the BI&A environments improve data availability and accessibility, automated reports, and an efficient and standardized implementation process of new data sources. The use of a calculation and definition tab supports the balanced scorecard and BI&A integration. The Balanced Scorecard characteristics enable performance measurement tools to be efficiently integrated within the BI&A architecture, focusing on descriptive analytics. The integrated design improves business performance management processes with a structured design, improving in-time informed decision-making.

Nevertheless, future research is needed as the current integration of the Balanced Scorecard and BI&A architecture reveals a lack of advanced analytic and visualization techniques. Also, the potential of Artificial Intelligence in this performance measurement system is rejected.

The research delivered a valuable and implementable Balanced Scorecard design integrated with a BI&A architecture. Therefore, this case study provides evidence that, in both theory and practice, integrating the Balanced Scorecard and BI&A environments enhances performance management in a mid-sized construction company. Future research should validate the scalability and applicability of the design research processes across the construction industry, advancing the practical adoption and implementation of data-driven, strategy-oriented performance management.

7 Reference list

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8 Appendix

Appendix A – Interview Guide (Dutch)

Interview Guide for managers.

Allereerst, welkom en bedankt voor uw deelname aan dit onderzoek. Voordat we gaan beginnen wil ik u eraan herinneren dat u het informed-consent formulier hebt ondertekend, akkoord bent de gestelde voorwaarden en geïnformeerd bent over uw rechten met betrekking tot dit interview. Met uw toestemming zal dit interview worden opgenomen (audio).

Ik begin met een korte introductie over mijzelf en ik herhaal het onderzoeksonderwerp kort.

0 Introductie

0.1 Vertel over jezelf, studie, carrière, werk, huidige functie (incl. ervaring) & verantwoordelijkheden?

0.2 Welke mate betrokken bij het meten of beoordelen van prestaties binnen uw afdeling of bedrijf?

0.3 Wat zijn momenteel de belangrijkste doelen van jouw afdeling/bedrijf? Bedrijfsdoelstellingen?

1 Huidige performance measurement

1.1 Hoe beoordeel je op dit moment hoe het bedrijf presteert?

1.1.1 Worden daarbij specifieke tools gebruikt?

1.1.2 Gebruik je daarbij KPI's of indicatoren? *Welke? Waarom?*

1.1.3 Hoe worden deze resultaten gedeeld of besproken? *Tijd-perspectief van resultaten?*

1.1.4 Worden daarbij specifieke tools gebruikt?

1.1.5 Hoe vaak wordt er gemeten?

1.1.6 Wat zijn de beperkingen/tekortkomingen van de huidige metingen volgens jou?

1.1.7 Hoe worden de inzichten gebruikt in besluitvorming? *Kun je voorbeelden geven?*

1.1.8 Heb je daar voldoende aan? *Waarom wel/niet?*

2 Strategie

2.1 Wat zijn voor de strategische doelen op korte/lange termijn voor (jouw bedrijf/afdeling/geheel)

2.1.1 Hoe wordt deze strategie bepaald?

2.1.2 Hoe wordt de strategie vertaald naar operationele doelen? (hoe vaak?)

2.1.3 In hoeverre worden deze meetbaar gemaakt? Voorbeelden?

2.1.4 Zijn dit vooral langetermijndoelen of projectdoelen? Zit daar een tijdsdoel bij (5 jaar?)

2.1.5 Op welke gebieden is je strategie gebaseerd?

2.1.6 Waar ligt de focus van het bedrijf daarbij? (Klanttevredenheid, innovatie, groei, efficiëntie)

2.1.7 Hoe kan focus van projecten richting het bedrijf totaal worden gestuurd?

2.1.8 Geconsolideerde wijze of per bedrijf?

3 Balanced scorecard

3.1 Ben je bekend/heb je ervaring met de Balanced Scorecard?

3.1.1 Zo ja, wat is jouw ervaring met de Balanced Scorecard? *Nee? Geef korte uitleg*

3.2 Welke financiële doelen of indicatoren zijn belangrijk voor jou?

3.2.1 5 belangrijke Financiële KPI's.

3.2.1 Zijn daar aanvullende financiële KPI's bij nodig?

3.2.2 Op het gebied van: Groei/Winstgevendheid/Omzet

3.2.3 Op het gebied van: Gebied van: Marktaandeel/omzet/resultaat op ...

3.2.4 Welke financiële onderdelen moeten zeker terugkomen in het overzicht?

3.3 Hoe meet het bedrijf klanttevredenheid of klantwaarde?

3.3.1 Welke doelen/indicatoren zijn daarbij het belangrijkste?

3.3.2 Wat zou hier nog aan verbeterd/toegevoegd kunnen worden?

3.3.3 Welke doelen zijn er op het gebied van klantrelaties?

3.3.4 In hoeverre zijn ketenpartners hierbij belangrijk?

3.4 Wordt de prestatie van interne processen gemeten? *Zo ja, welke en hoe?*

3.4.1 Hoe wordt Kwaliteit bij het bedrijf gemeten?

3.4.2 Waar is er ruimte voor verbetering in interne efficiëntie

3.4.2 Hoe wordt kwaliteit bij het bedrijf gemeten?

3.4.3 In hoeverre geldt dit voor productiviteit: Tijd, kwaliteit, product, kosten

3.4.2 Zijn daar aanvullende KPI's bij nodig?

3.5 Hoe wordt de ontwikkeling van personeel, kennis of innovatie op dit moment beoordeeld?

3.5.1 Welke indicatoren of doelen zijn er op dit gebied

3.5.2 Wat zou hierin het best gemeten kunnen worden? Zijn daar aanvullende KPI's bij nodig?

3.5.3 Procestijden = indicatie voor leerresultaat.

3.5.4 Groeiperspectief: toekomstbestendig maken

3.6 Welke andere perspectieven – buiten Financieel, klantperspectief, interne processen, leren & groei/innovatie - uit de strategie van het bedrijf, zijn belangrijk om te meten hoe je bedrijf/afdeling presteert? Waarom? (*e.g. Corporate social responsibility, circulariteit, duurzaamheid, milieu*)

3.6.1 Hoe worden deze vertaald naar doelen?

3.6.1 Hoe zou je deze doelen willen meten?

3.6.2 Welke KPI's zou je daar aan willen meten?

3.7 Hoe verhouden de doelen of indicatoren zich tussen de bedrijven/afdelingen en de organisatie brede strategie?

3.8 Idealiter, wat zou jij in de toekomst nog graag nog willen meten binnen het bedrijf? *Waarom?*

4 Data-gedreven prestatiemetingen

4.1 Hoe sta jij tegenover het gebruik van dashboards en prestatie-indicatoren in je werk? En hoe denken je collega's daarover?

4.2 Welke aspecten zijn belangrijk in het design om de bedrijfsprestaties te laten zien?

4.3 Welke voorwaarden heb je om een systeem als de Balanced Scorecard te gebruiken? Wie hoort dit in te kunnen zien?

4.4 Met welke frequentie zou je de prestaties van jouw afdeling/bedrijf willen zien? *Wekelijks, maandelijks, jaarlijks?*

4.5 Denk je dat het meten en tonen van de bedrijfsprestaties in één overzicht helpt om het bedrijf beter te laten presteren?

4.6 In hoeverre moeten de overige doelstellingen in het dashboard (niet-financieel) flexibel zijn?

5 Afsluiting

5.1 Wat zou volgens u een goed presterende organisatie als het bedrijf moeten meten?

5.2 Zijn er nog andere zaken die u belangrijk vindt rondom prestatiemeting of strategie die we niet besproken hebben?

Dit is het einde van het interview. Heeft u nog aanvullende opmerkingen? Heb ik iets over het hoofd gezien of zijn er zaken waarover u nog iets wil vertellen dat mogelijk waardevol is voor mijn onderzoek?

Appendix B – Business needs template

Figure 31: Business needs template with sample question/prompts/topics

Participant/Document:	Consent:
Date:	Checked:
Interviewer(s):	

Question/Prompt/Topic	Participant / document statement:	Interpreted business need
Strategy – Financial goals		
Data – Financial		
Objective – Learning and Innovation		

Note. Own work based on *Product design and development* by Ulrich, K. T., & Eppinger, S. D, 2016, (p. 82)

Appendix C – Informed Consent sheet (Dutch)

Informatieblad voor onderzoek '[Performance Measurement & BI&A]'

Doel van het onderzoek

Dit onderzoek wordt geleid door J. Holtmaat.

Het doel van dit onderzoek is om te onderzoeken hoe de Balanced Scorecard, een systeem voor het meten van bedrijfsprestaties, toegepast kan worden binnen het bedrijf als voorbeeld van een middelgroot bedrijf in de Nederlandse bouwsector. Daarbij worden Business Intelligence en Analytische systemen gebruikt om bedrijfsdata om te zetten in begrijpelijke bedrijfsinformatie. De onderzoeksgegevens worden gebruikt om een beeld te krijgen van de huidige én gewenste metingen van bedrijfsprestaties van het bedrijf. Door het ontwerpen van een data-gedreven systeem voor de bedrijfsprestaties van het bedrijf, wordt de gewenste situatie in kaart gebracht. Informatie wordt gebruikt in combinatie met academische rapporten en wetenschappelijke artikelen, maar wordt zo veel mogelijk geanonimiseerd. De hoofdvraag die daarbij wordt beantwoord is: *"How can a balanced performance measurement system be applied in a Dutch construction company, using business intelligence and analytics systems to enhance performance management?"*

Hoe gaan we te werk?

U neemt deel aan een onderzoek waarbij we informatie zullen vergaren door:

- U te interviewen en uw antwoorden te noteren/op te nemen via een audio-opname. Er zal ook een transcript worden uitgewerkt van het interview.

Uitsluitend ten behoeve van het onderzoek zullen de verzamelde onderzoeksgegevens worden gedeeld met het bedrijf.

Potentiële risico's en ongemakken

- Er zijn geen fysieke, juridische of economische risico's verbonden aan uw deelname aan deze studie. U hoeft geen vragen te beantwoorden die u niet wilt beantwoorden. Uw deelname is vrijwillig en u kunt uw deelname op elk gewenst moment stoppen.

Vergoeding

U ontvangt voor deelname aan dit onderzoek geen vergoeding.

Vertrouwelijkheid van gegevens

Wij doen er alles aan uw privacy zo goed mogelijk te beschermen. Er wordt op geen enkele wijze vertrouwelijke informatie of persoonsgegevens van of over u naar buiten gebracht, waardoor iemand u zal kunnen herkennen.

Voordat onze onderzoeksgegevens naar buiten gebracht worden, worden uw gegevens zoveel mogelijk geanonimiseerd, tenzij u in ons toestemmingsformulier expliciet toestemming heeft gegeven voor het vermelden van uw naam, bijvoorbeeld bij een quote.

In een publicatie zullen anonieme gegevens of pseudoniemen worden gebruikt. De audio-opnamen, formulieren en andere documenten die in het kader van deze studie worden gemaakt of verzameld, worden opgeslagen op een beveiligde locatie bij de Universiteit Twente en op de beveiligde (versleutelde) gegevensdragers van de onderzoekers.

De onderzoeksgegevens worden na het onderzoek bewaard voor een periode van 0 maand. Uiterlijk na het verstrijken van deze termijn zullen de gegevens worden verwijderd of worden geanonimiseerd zodat ze niet meer te herleiden zijn tot een persoon.

De onderzoeksgegevens worden indien nodig (bijvoorbeeld voor een controle op wetenschappelijke integriteit) en alleen in anonieme vorm ter beschikking gesteld aan personen buiten de onderzoeksgroep.

Tot slot is dit onderzoek beoordeeld en goedgekeurd door de ethische commissie van de faculteit BMS (domain Humanities & Social Sciences).

Vrijwilligheid

Deelname aan dit onderzoek is geheel vrijwillig. U kunt als deelnemer uw medewerking aan het onderzoek te allen tijde stoppen, of weigeren dat uw gegevens voor het onderzoek mogen worden gebruikt, zonder opgaaf van redenen. Het stopzetten van deelname heeft geen nadelige gevolgen voor u of de eventueel reeds ontvangen vergoeding.

Als u tijdens het onderzoek besluit om uw medewerking te staken, zullen de gegevens die u reeds hebt verstrekt tot het moment van intrekking van de toestemming in het onderzoek gebruikt worden.

Wilt u stoppen met het onderzoek, of heeft u vragen en/of klachten? Neem dan contact op met de onderzoeksleider.

Onderzoeker:

J. Holtmaat

E-mail:

Telephone:

Voor bezwaren met betrekking tot de opzet en of uitvoering van het onderzoek kunt u zich ook wenden tot de Secretaris van de Ethische Commissie / domein Humanities & Social Sciences van de faculteit Behavioural, Management and Social Sciences op de Universiteit Twente via ethicscommittee-hss@utwente.nl. Dit onderzoek wordt uitgevoerd vanuit de Universiteit Twente, faculteit Behavioural, Management and Social Sciences. Indien u specifieke vragen hebt over de omgang met persoonsgegevens kun u deze ook richten aan de Functionaris Gegevensbescherming van de UT door een mail te sturen naar dpo@utwente.nl.

Tot slot heeft u het recht een verzoek tot inzage, wijziging, verwijdering of aanpassing van uw gegevens te doen bij de Onderzoeksleider.

Door dit toestemmingsformulier te ondertekenen erken ik het volgende:

1. Ik ben voldoende geïnformeerd over het onderzoek door middel van een separaat informatieblad. Ik heb het informatieblad gelezen en heb daarna de mogelijkheid gehad vragen te kunnen stellen. Deze vragen zijn voldoende beantwoord.
2. Ik neem vrijwillig deel aan dit onderzoek. Er is geen expliciete of impliciete dwang voor mij om aan dit onderzoek deel te nemen. Het is mij duidelijk dat ik deelname aan het onderzoek op elk moment, zonder opgaaf van reden, kan beëindigen. Ik hoef een vraag niet te beantwoorden als ik dat niet wil.

Naast het bovenstaande is het hieronder mogelijk voor verschillende onderdelen van het onderzoek specifiek toestemming te geven. U kunt er per onderdeel voor kiezen wel of geen toestemming te geven. Indien u voor alles toestemming wil geven, is dat mogelijk via de aanvinkbox onderaan de stellingen.

3. Ik geef toestemming om de gegevens die gedurende het onderzoek bij mij worden verzameld te verwerken zoals is opgenomen in het bijgevoegde informatieblad. Deze toestemming ziet dus ook op het verwerken van gegevens betreffende mijn gezondheid/ras/etnische afkomst/politieke opvattingen/religieuze en of levensbeschouwelijke overtuigingen/lidmaatschap van vakbond/seksueel gedrag/seksuele gerichtheid en/of over mijn genetische gegevens/biometrische gegevens.	JA <input type="checkbox"/>	NEE <input type="checkbox"/>
4. Ik geef toestemming om tijdens het interview opnames (geluid / beeld) te maken en mijn antwoorden uit te werken in een transcript.	<input type="checkbox"/>	<input type="checkbox"/>
5. Ik geef toestemming om mijn antwoorden te gebruiken voor quotes in de onderzoekspublicatie.	<input type="checkbox"/>	<input type="checkbox"/>
6. Ik geef toestemming om de bij mij verzamelde onderzoeksdata te bewaren en te gebruiken voor toekomstig onderzoek en voor onderwijsdoeleinden.	<input type="checkbox"/>	<input type="checkbox"/>
Ik geef toestemming voor alles dat hierboven beschreven staat.	<input type="checkbox"/>	

Naam Deelnemer:

Naam Onderzoeker:

J. Holtmaat

Handtekening:

Handtekening:

Datum:

Datum:

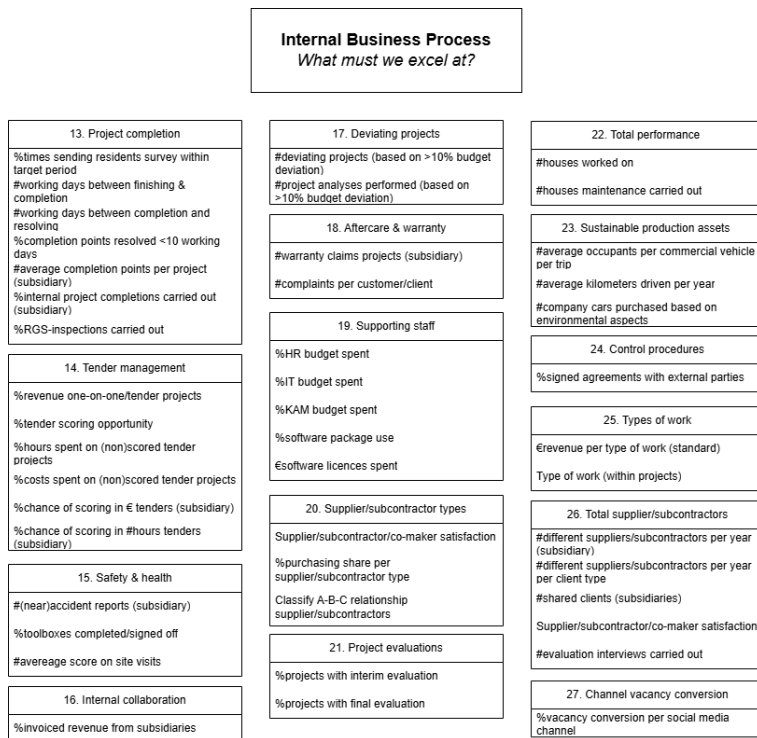
Appendix D – Interpreted business needs

Figure 32: Interpreted business needs Customer perspective



Note. Own work

Figure 33: Interpreted business needs Internal Business Process perspective



Note. Own work

Figure 34: Interpreted business needs Financial perspective

Financial <i>How do we look to Shareholders?</i>		
28. Key figure €key figure Key figure = coverage margin result + post-calculation result + budget result + sick result	33. Investments €investment budget %investment budget growth €investments in sustainable means of production (fixed assets) %investment budget spent	38. Risk management #clients with revenue share > . % %revenue share at housing associations <70% %revenue share social housing rents
29. Overhead coverage coverage margin result = preliminary calculation coverage - post-calculated coverage €coverage margin result #hours coverage margin result %overhead costs of revenue	34. Profitability preliminary calculated profit margin post calculated profit margin €profit (before tax) = revenue - costs (variable & fixed)	39. Invoicing/payment arrears Invoicing arrears = %invoiced revenue expected - actual invoiced revenue Payment arrears = %
30. Post-calculation (efficiency) post-calculation result = preliminary calculated revenue - post-calculated revenue €post-calculation result #hours post-calculation result	35. Operating cash flow/business valuation EBITDA	40. Depreciation €average actual depreciation €average accounting depreciation
31. Sick result Sick-result = reserved sick pay - actual sick pay €sick result #hours sick result	36. Revenue (turnover) %revenue composition (subcontractors-material-hours) %revenue growth €invoiced revenue (subsidiary) €revenue per employee (subsidiary)	41. Revenue forecast Revenue forecast (risk & opportunities)
32. Budget result Budget result = budgeted budget - actual budget spent €budget result	37. Marketing performance €spent on marketing campaigns %marketing campaign budget spent	42. Financial ratio's Current ratio >1 Solvency >25% and <40% Profitability (before tax)
		43. Average costs/revenue per house €average costs per house €average revenue per house

Note. Own work

Figure 35: Interpreted business needs Learning & Growth perspective

Learning & Growth <i>Can we continue to improve, innovate and create value?</i>		
44. Employee satisfaction Employee satisfaction (subsidiary) Measure unguarded moment Employee satisfaction themes Internal forms application Measure 1x - 2x - 4x per year	47. Training & education #training & education courses taken per year #days of training for middle management level %employees received training for development %education/training budget spent €education/training budget spent	50. Certifications #Emergency Response Officers (ERO) %ERO employees #Safety Health and Environment (SHE) certificates (registered for course) %employees SHE certified
45. Workforce characteristics employee average years of service #total internal & external employees %annual employee turnover employee in- and outflow %employees multi-deployable Employee composition distribution (age, diversity, background)	48. Interns, students & graduates #student, internship & graduation workplaces (vacancies) #total interns, apprentices & graduates #interns & graduates active #apprentice active #interns, students & graduates recruited from educational institutions % intern-to-employee conversion #interns & graduates hired to employee %interns of total craftsman	51. Recruitment #employees hired (subsidiary) #staff hired in required position %lead time entry process within target %vacancy lead time within target vacancy lead time days job interview procedure lead time #vacancies per year (subsidiary)
46. Absenteeism %absenteeism %sickness absence (incl. short and long term absence) %sickness absence per age category	49. Personal Development %employees with Personal Development Plan (PDP) %performance review interviews conducted %employees with annual Personal Development Plan review #interns & graduates hired to employee	52. Network #partnerships with regional educational institutions #interns & graduates hired to employee #open days

Note. Own work

Figure 36: Interpreted business needs Corporate Social Responsibility perspective

Corporate Social Responsibility How do we contribute to society and the environment?		
53. Emissions #CO2-footprint %CO2-emissions compensated %CO2-emissions reduced %CO2-emissions from vehicle fleet	55. Circularity & recycling #kg/tonnes waste #kg/tonnes raw material use %waste diverted to recycling, reusability or useful application %waste removed and disposed	57. Social Return on Investment (SROI) #participating in open days #PSO quality mark #open house/days organized for students #guest lectures given to students #jobs created by regional projects %profit donated to charities in- and outside the Netherlands
54. Environment #kg/tonnes waste #kg/tonnes raw material use #Solar energy generated by solar panels #Sustainable heating #ton CO2 saved by reusing raw materials	56. CSR initiatives €sustainable investments that contribute to reducing CO2-emissions #sustainable initiatives #social initiatives supported #houses made more sustainable #solar panels installed %houses made sustainable to label A++	58. Mobility #transport movements to- and -from business locations and sites

Note. Own work

Appendix E – Literature-Based Performance Indicators

Customer perspective

Table 20: Literature-Based Performance Indicators customer perspective

Indicator	Metric/Measure	Reference
Brand recognition	Brand awareness	(Kaplan & Norton, 1996)
Client acquisition	% new clients attracted/won	(Kaplan & Norton, 1996)
Client dependency	Partnerships	(Kaplan & Norton, 1992)
Client profitability	% net profit per client type	(Kaplan & Norton, 1996)
Client relationship/loyalty	% annual purchase growth clients	(Figge et al., 2001) (Kaplan & Norton, 1996)
Client retention	% Client retention rate	(Sharda et al., 2014) (Lawrie & Cobbold, 2004) (Kaplan & Norton, 1996)
Client satisfaction product	Average satisfactions score	(Dauerer, 2025) (Koprivica et al., 2021) (Frederico et al., 2021) (Bassioni et al., 2004) (Kagioglou et al., 2001) (Figge et al., 2001)
Client satisfaction service	Average satisfactions score	(Dauerer, 2025) (Koprivica et al., 2021) (Barros et al., 2020) (Bassioni et al., 2004) (Kagioglou et al., 2001) (Kaplan & Norton, 1996) (Kaplan & Norton, 1992)
Client type	% revenue client type	(Kaplan & Norton, 1996)
Image and reputation	Marketing expenses	(Koprivica et al., 2021) (Figge et al., 2001) (Kaplan & Norton, 1996)
Interaction	Level of customer interaction on processes	(Frederico et al., 2021)
Market share	% market share	(Koprivica et al., 2021) (Frederico et al., 2021) (Figge et al., 2001) (Kaplan & Norton, 1996)
Participant/Resident satisfaction	Average satisfaction score	(Chan & Chan, 2004)
Supplier satisfaction	Average satisfactions score	(Kagioglou et al., 2001)
Supplier performance review	Nr. Planned vs executed evaluation interviews	(Koprivica et al., 2021) (Kagioglou et al., 2001)
Value creation	Economic value added (EVA)	(Koprivica et al., 2021)

Note. Own work

Internal Business perspective

Table 21: Literature-Based Performance Indicators internal business process perspective

Indicator	Metric/Measure	Reference
Collaboration	Level of collaboration	(Frederico et al., 2021)
Construction time	Time from approval to practical completion	(Murray, 2008) (Bassioni et al., 2004) (Kaplan & Norton, 1996)
Defects/completion points	Nr. Of defects/completion points on handover	(Barros et al., 2020) (Murray, 2008) (Bassioni et al., 2004)

		(Chan & Chan, 2004) (Kagioglou et al., 2001) (Kaplan & Norton, 1996)
Defect treatments	Resolved completion points within time	(Sharda et al., 2014) (Kaplan & Norton, 1996)
Differentiating characteristics	Project performance attributes	(Kaplan & Norton, 1996)
Efficiency	% Conversion of labor, materials, and equipment of completed product/service	(Barros et al., 2020) (Kaplan & Norton, 1996)
Efficiency	Process efficiency	(Frederico et al., 2021)
Lead time	Time required from order to completion	(Kaplan & Norton, 1996) (Kaplan & Norton, 1992)
Material suppliers	Evaluation of material suppliers	(Barros et al., 2020)
Future trends	% project use of recycled products	(Koprivica et al., 2021)
Operating process efficiency	% assigned budget spent	(Kaplan & Norton, 1996)
Postsale treatment	% client request handled with single call	(Kaplan & Norton, 1996)
Predictability	Nr. Of projects completed on time and within budget	(Barros et al., 2020) (Murray, 2008) (Bassioni et al., 2004)
Production costs	% direct project/product costs of revenue	(Figge et al., 2001) (Kaplan & Norton, 1996) (Kaplan & Norton, 1992)
Productivity	Value added per employee	(Horta et al., 2010) (Murray, 2008) (Bassioni et al., 2004) (Kaplan & Norton, 1996)
Safety/Accidents	Accident Frequency Rate (AFR) Nr. Of reportable accidents	(Dauerer, 2025) (Barros et al., 2020) (Horta et al., 2010) (Murray, 2008) (Chan & Chan, 2004) (Bassioni et al., 2004)
Time quality	On-time delivery accuracy %	(Kaplan & Norton, 1992)
Unique project performance	Accuracy, size, speed, clarity, or energy consumption	(Kaplan & Norton, 1996)
Warranty & aftercare	Warranty claims per project/service	(Chan & Chan, 2004) (Kaplan & Norton, 1996)
Waste reduction	% waste reduction adjusted for revenue	(Koprivica et al., 2021) (Frederico et al., 2021) (Kaplan & Norton, 1996)

Note. Own work

Financial perspective

Table 22: Literature-Based Performance Indicators financial perspective

Indicator	Metric/Measure	Reference
Capital costs	€ costs excluding land and finance	(Frederico et al., 2021)
Capital performance	Cash-to-Cash cycle	(Kaplan & Norton, 1996)
Cash flow	EBITDA	(Frederico et al., 2021) (Kaplan & Norton, 1992)
Cost of changes	% costs of changes made during construction	(Barros et al., 2020)
Extreme projects	Deviations from the cost of construction	(Barros et al., 2020)
Gross profit	Gross profit (vs. potential)	(Sharda et al., 2014) (Kaplan & Norton, 1996)

Hanging Invoice	€ Accounts receivable	(Horta et al., 2010)
Insurance	Gross recovery of CAR claims/turnover	(Kagioglou et al., 2001)
Market share	% Market share growth	(Kaplan & Norton, 1992)
Productivity improvement	% Cost reduction growth	(Koprivica et al., 2021) (Barros et al., 2020) (Chan & Chan, 2004) (Kaplan & Norton, 1996)
Profitability	% profit (before tax) of revenue	(Frederico et al., 2021) (Horta et al., 2010) (Murray, 2008) (Bassioni et al., 2004) (Chan & Chan, 2004) (Figge et al., 2001)
Profitability	% Return on Equity (ROE)	(Koprivica et al., 2021) (Kaplan & Norton, 1992)
Profitability	% EBIT margin	(Koprivica et al., 2021)
Profit margin	Forecast profit margin/post calculation profit margin	(Kagioglou et al., 2001)
Revenue	% revenue growth	(Koprivica et al., 2021) (Horta et al., 2010) (Murray, 2008) (Kagioglou et al., 2001) (Figge et al., 2001) (Kaplan & Norton, 1996) (Kaplan & Norton, 1992)
Risk management	% revenue of different revenue sources (clients)	(Kaplan & Norton, 1996)
ROCE	% Return on Capital Employed	(Lawrie & Cobbold, 2004) (Figge et al., 2001)
Value creation	Economic Value added	(Koprivica et al., 2021) (Frederico et al., 2021) (Kaplan & Norton, 1996)
Working capital	Net Working Capital (NWC)	(Kaplan & Norton, 1996)

Note. Own work

Learning & Growth perspective

Table 23: Literature-Based Performance Indicators learning & growth perspective

Indicator	Metric/Measure	Reference
Absenteeism	% Abstenteeism (due to illness)	(Barros et al., 2020)
Climate for action	Employee health & safety	(Figge et al., 2001)
Continuous solutions	% revenue from innovative products/projects	(Kaplan & Norton, 1992)
Critical technical infrastructure	Information system availability relative to needs	(Torgautov et al., 2022) (Figge et al., 2001) (Kaplan & Norton, 1996) (Kaplan & Norton, 1992)
Employee performance review		(Kagioglou et al., 2001)
Employee productivity	Revenue per employee	(Kaplan & Norton, 1996)
Employee retention	% key staff turnover	(Kaplan & Norton, 1996)
Employee retention	% employee turnover	(Sharda et al., 2014)
Employee satisfaction	Employee satisfactions score	(Koprivica et al., 2021) (Barros et al., 2020) (Hansen & Schaltegger, 2016) (Figge et al., 2001) (Kaplan & Norton, 1996)

Employee satisfaction	% employee satisfaction interviews conducted	(Koprivica et al., 2021)
Innovation and improvement	% revenue new markets	(Kaplan & Norton, 1992)
Innovation and improvement	% revenue new products	(Kaplan & Norton, 1992)
Investments	% investment budget spent on new products/services	(Kaplan & Norton, 1996)
Motivation and empowerment	Nr. Of suggestions per employee	(Koprivica et al., 2021) (Kaplan & Norton, 1996)
Motivation and empowerment	Nr. Of suggestions implemented	(Kaplan & Norton, 1996)
New products	Time to market	(Kaplan & Norton, 1992)
New products	% revenue from new products/services	(Kaplan & Norton, 1996)
New product introduction	Actual introduction time vs. plan	(Kaplan & Norton, 1992)
Organizational alignment	Strategy awareness survey	(Kaplan & Norton, 1996)
Process improvement	Half-life metric (time to improve processes 50%)	(Kaplan & Norton, 1996)
Research & development	% Conversion of labor, materials, and equipment of new R&D products/service	(Kaplan & Norton, 1996)
Skill/competences mix		(Frederico et al., 2021) (Kagioglou et al., 2001) (Figge et al., 2001) (Kaplan & Norton, 1992)
Staff competencies	Nr. Of employees qualified for strategic jobs to organizational needs	(Kaplan & Norton, 1996)
Strategic information availability	% processes with real time quality, time, and costs report	(Torgautov et al., 2022) (Lawrie & Cobbold, 2004) (Kaplan & Norton, 1996)
Strategic information availability	% online report availability at clients	(Kaplan & Norton, 1996)
Team building & performance	Internal teaming survey conducted	(Koprivica et al., 2021) (Kaplan & Norton, 1996)
Team building & performance	Integrated engagement: nr. Projects with more than one business unit participating.	(Kaplan & Norton, 1996)
Training & Education	Training hours/days per employee	(Dauerer, 2025) (Koprivica et al., 2021) (Barros et al., 2020)
Training levels	Level of reskilling & required workforce % needing reskilling	(Kaplan & Norton, 1996)

Note. Own work

Corporate Social Responsibility

Table 24: Literature-Based Performance Indicators corporate social responsibility perspective

Indicator	Metric/measure	Reference
Emission control	Emission and air pollution	(Dauerer, 2025)
Consumption	Water & energy consumption	(Barros et al., 2020)
Environmental education and trainings	Training hours per employee	(Dauerer, 2025)
Environmental performance	Environmental Impact Assessment (EIA) Scores	(Barros et al., 2020) (Chan & Chan, 2004)
Production	Recycled material use	(Dauerer, 2025)
Regulations and standards	Certifications/quality marks	(Dauerer, 2025)
SROI	Investments in society	(Dauerer, 2025)
SROI	Contributed value to society	(Dauerer, 2025)
Waste	Waste during project process	(Kaplan & Norton, 1996)

Note. Own work

Appendix F – Balanced Scorecard voting outcome

Figure 37: Balanced Scorecard subject voting outcome

#	Subject	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6	Total
7	Customer satisfaction	1	1	1	1	1	1	6
77	SROI	1	1	1	1	1	1	6
10	Client type	1		1	1	1	1	5
17	Project completion	1	1	1	1		1	5
19	Safety & health	1	1	1	1		1	5
29	Types of work	1		1	1	1	1	5
47	Revenue (turnover)	1	1	1	1		1	5
56	Employee satisfaction	1	1	1	1		1	5
2	Partnership contracts		1	1	1	1		4
6	Resident satisfaction		1	1	1	1		4
11	Order portfolio	1	1	1	1			4
38	Key figure	1	1		1	1		4
45	Profitability		1	1	1		1	4
51	Revenue forecast		1	1	1	1		4
61	Personal development		1	1	1	1		4
13	Client acquisition	1				1	1	3
18	Tender management	1			1		1	3
46	Operating cash flow/business valuation	1		1			1	3
50	Invoicing/payment arrears	1	1	1				3
52	Financial ratio's	1			1		1	3
57	Workforce characteristics				1	1	1	3
58	Absenteeism	1		1			1	3
59	Training & education		1		1	1		3
22	Aftercare & warranty	1					1	2
37	Productivity					1	1	2
63	Recruitment	1		1				2
67	Information system capabilities	1				1		2
70	Motivation & empowerment	1				1		2
72	Emissions		1				1	2
4	Specific clients					1		1
8	Client relationship/retention		1					1
15	Image and reputation					1		1
20	Internal collaboration			1				1
21	Deviating projects		1					1
24	Suppliers/subcontractor types					1		1
25	Project evaluations		1					1
32	Project lead time						1	1
35	Predictability			1				1
40	Post-calculation (efficiency)					1		1
48	Marketing performance		1					1
53	Average costs/revenue per house						1	1
60	Interns, students & graduates				1			1
75	Circularity & recycling					1		1
1	Social media							0
3	Brand awareness							0
5	Market share							0
9	Total clients							0
12	Housing association dependency							0
14	Client interaction							0
16	Value creation							0
23	Supporting staff							0
26	Total performance							0
27	Sustainable production assets							0
28	Control procedures							0
30	Total supplier/subcontractors							0
31	Channel vacancy conversion							0
33	Postsale treatment							0
34	Supplier/subcontractor satisfaction							0
36	Project efficiency							0
39	Overhead coverage							0
41	Sick result							0
42	Budget result							0
43	Depreciation							0
44	Investments							0
49	Risk management							0
54	Insurance performance							0
55	Capital efficiency							0
62	Certifications							0
64	Network							0
65	Innovation/solution performance							0
66	R&D processes							0
68	Team building & performance							0
69	Innovation & learning climate							0
71	Skill/capability/competency mix							0
73	Environment							0
74	Consumption							0
76	CSR initiatives							0
78	Mobility							0
79	CSR education & certificates							0
80	Total	20	20	20	20	20	20	120

Note. Own work

Appendix G – Prototype design calculations & definitions

Learning & Growth perspective

Table 25: Learning and Growth metrics and data overview

Objective	Metric/calculation	Data Source	Data Object	Data points
Improving & maintaining employee satisfaction	The average employee satisfaction score of the company's employees = $\text{Sum scores per employee} / \text{satisfaction themes} / \text{survey replies}$	MoreApp (Forms)	Forms data – Satisfaction survey data	<ul style="list-style-type: none"> Sum scores per employee satisfaction theme # satisfaction themes # survey replies
Reducing absenteeism	Sickness absence rate (%) = $\text{Summed weekly sickness absence rate} / \text{weeks}$	CBBS – HR-Online (HRM)	Employee data	<ul style="list-style-type: none"> Days Sick report per week (short, mid- long-term) # workable days per week # weeks
Stimulate growth through Personal Development Plans (PDP)	PDPs per permanent employees (%) = $\text{PDPs of permanent employees} / \text{employees in permanent employment} > 1 \text{ year}$	CBBS – HR-Online (HRM)	Employee data	<ul style="list-style-type: none"> # PDPs of permanent employees # employees in permanent employment > 1 year

Note. Own work

Internal Business Process perspective

Table 26: Internal Business Process metrics and data overview

Objective	Metric/calculation	Data Source	Data Object	Data points
Ensure timely & high-quality completion of projects	Average number of completion points per house per project = $\text{Total completion points} / \text{total projects} / \text{total houses per project}$	MoreApp (Forms)	Forms data – Inspection/completion data	<ul style="list-style-type: none"> # total houses per project # total projects # total completion points
Improve safety & health performance on works	The total number of (near)accidents % = $((\text{near})\text{accident reports } 2025 / (\text{near})\text{accident reports } 2024 * 100\%) - 100\%$	MoreApp (Forms)	Forms data – Quality, Health & Safety, Environment data	<ul style="list-style-type: none"> # submitted (near)accident reports 2024 # submitted (near)accident reports 2025
Strengthen tender management processes	The average chance of winning tenders = $(\# \text{won tenders} / \# \text{calculated}) + (\text{€won tenders} / \text{€calculated}) / 2$	Craftview Gilde (ERP & CRM)	ERP data – Financial/Offer data	<ul style="list-style-type: none"> # tender or one-on-one project type # and € of tender projects calculated # and € of tender projects won
Expand order portfolio	The total order portfolio % of projected revenue = $(\text{€total order portfolio} / \text{€projected annual revenue}) * 100\%$	Craftview Gilde (ERP & CRM)	ERP data – Financial/Offer data	<ul style="list-style-type: none"> Total order portfolio in € Projected annual revenue in €

Note. Own work

Corporate Social Responsibility perspective

Table 27: Corporate Social Responsibility metrics and data overview

Objective	Metric/calculation	Data Source	Data Object	Data points
Increase Social Return on Investment through CSR initiatives	$SROI \text{ ratio growth} = ((SROI \text{ ratio } 2025 / SROI \text{ ratio } 2024) * 100\%) - 100\%$	Craftview Gilde (ERP & CRM)	ERP data – Project data ERP data – Client/Customer data	<ul style="list-style-type: none"> SROI ratio 2024 = $(\text{€ social value added} / \text{€ invested projects})$ SROI ratio 2025 = $(\text{€ social value added} / \text{€ invested projects})$

Note. Own work

Customer perspective

Table 28: Customer metrics and data overview

Objective	Metric Calculation	Data Source	Data Object	Data points
Maintain & Improve customer satisfaction	The average customer satisfaction score per customer = $\text{Summed scores customer} / \text{satisfaction themes} / \text{survey replies}$	MoreApp (forms)	Forms data – Satisfaction survey data	<ul style="list-style-type: none"> Summed scores customer satisfaction # satisfaction themes # survey replies
Maintain & Improve resident satisfaction	The average customer satisfaction score per customer = $\text{Summed scores resident} / \text{satisfaction themes} / \text{survey replies}$	MoreApp (forms)	Forms data – Satisfaction survey data	<ul style="list-style-type: none"> Summed scores resident satisfaction # satisfaction themes # survey replies
Expand long-term partnerships with clients, suppliers & co-makers	Newly signed RGS partnership contracts = $\text{Registered RGS partnerships } 2025 - \text{Registered RGS partnerships } 2020-2024$	VastWare (Long-term property management)	RGS-partnership data	<ul style="list-style-type: none"> # RGS partnerships registered 2020-2024 # RGS partnerships registered 2025
Broaden share of activities across client types	The revenue share of the biggest client type in total revenue = $(\text{€ revenue biggest client type} / \text{€ revenue all client types}) * 100\%$	Craftview Gilde (ERP & CRM)	ERP data – Financial/Offer data	<ul style="list-style-type: none"> Client types Total revenue in € Total revenue biggest client type in €
Diversify portfolio of services	Biggest work type share of total revenue = $(\text{€ revenue biggest work type} / \text{€ revenue all work types}) * 100\%$	Craftview Gilde (ERP & CRM)	ERP data – Project data	<ul style="list-style-type: none"> Work types Total revenue in € Total revenue per work type in €

Note. Own work

Financial perspective

Table 29: Financial metrics and data overview

Objective	Metric/calculation	Data Source	Data Object	Data points
Achieve revenue prognosis growth	Risk adjusted revenue prognosis growth = $((\text{€ revenue prognosis } 2025 / \text{€ revenue prognosis } 2024) * 100\%) - 100\%$	MS Excel & Craftview Gilde (ERP & CRM)	Prognosis data	<ul style="list-style-type: none"> Risk adjusted revenue prognosis 2024 in € Risk adjusted revenue prognosis 2025 in €
Meet overall financial target	Key figure = Key figure in €	Craftview Gilde (ERP & CRM)	ERP data – Financial/Offer data	<ul style="list-style-type: none"> Weekly key-figure in €

Increase profitability	The profit (before tax) margin of the total revenue = <i>(€ profit (before tax) / € total revenue) *100%</i>	Craftview Gilde (ERP & CRM)	ERP data – Financial/Offer data	<ul style="list-style-type: none"> • Profit (before tax) in € • Total revenue in €
Grow total revenue	Revenue growth = <i>((€ revenue 2025 / € revenue 2024) *100%) – 100%</i>	Craftview Gilde (ERP & CRM)	ERP data – Financial/Offer data	<ul style="list-style-type: none"> • Total revenue over 2024 in € • Total revenue over 2025 in €
Improve EBITDA margin	EBITDA margin of total revenue = <i>(€ EBITDA / € total revenue)*100%</i>	Craftview Gilde (ERP & CRM)	ERP data – Financial/Offer data	<ul style="list-style-type: none"> • Total revenue in € • EBITDA in €
Maintain a positive invoicing position	Average weekly invoicing delays = <i>€ summed weekly invoicing delays / weeks</i>	Windream BPM (Invoicing)	Invoice data	<ul style="list-style-type: none"> • Summed weekly invoicing delays in € • # weeks
Sustain financial health	Average monthly solvency ratio = <i>(€ total equity / € total assets) * 100%</i> liquidity current ratio = <i>€ total current assets / € total current liabilities</i>	Craftview Gilde (ERP & CRM)	ERP data – Financial/Offer data	<ul style="list-style-type: none"> • Total Equity € • Total Assets € • Total Current Assets € • Total current liabilities €

Note. Own work