

UNIVERSITY OF LJUBLJANA
SCHOOL OF ECONOMICS AND BUSINESS

MASTER'S THESIS

**ASSESSING READINESS FOR BUSINESS ANALYTICS ADOPTION:
THE CASE OF A SMALL RETAIL COMPANY IN SERBIA**

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AUTHORSHIP STATEMENT

The undersigned Tijana Milović, a student at the University of Ljubljana, School of Economics and Business, (hereafter: SEB LU), author of this written final work of studies with the title “Assessing readiness for business analytics adoption: the case of a small retail company in Serbia”, prepared under supervision of prof. Jurij Jaklič, PhD.

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LIST OF ABBREVIATIONS

BA – Business analytics

BI – Business Intelligence

CSF – Critical Success Factors

DOI – Diffusion of Innovation

DSS – Decision Support Systems

IS – Information Systems

IT – Information Technology

KPI – Key Performance Indicator

KSF – Key Success Factors

RF – Readiness Factors

ROI – Return on Investment

SF – Success Factors

SME – Small and Medium Enterprise

TOE – Technology, Organization and Environment

INTRODUCTION

In recent years, there has been a tremendous flow of data large in volume, variety and velocity, that can be used for business purposes. New sources of data, together with the usage of statistical tools and gained theoretical and domain knowledge resulted in improvement in data quality and implementation possibilities (Bradlow, Gangwar, Kopalle & Voleti, 2017). It is precisely the capacity to turn massive amounts of ambiguous data into valuable information in the shortest amount of time that provides today's businesses with a substantial competitive edge (Hočevar & Jaklič, 2010). The demand for enhanced decision-making capability has resulted in the creation of Business Analytics (BA).

The adoption of information technology, built particularly to help with the company's administrative and managerial tasks, has considerably enhanced people's forecasting possibilities. (Gibson & Arnott, 2004). Thanks to the modern approach, retailers can make various business analyses such as cross-sectional market baskets, complementary and substitute products, analyse cumulative sales and inventory movements, calculate price elasticities and evaluate the aggregate effects of pricing, promotions, and product characteristics on sales (Bradlow, Gangwar, Kopalle, & Voleti, 2017). BA provides better organizational performance and higher profitability, superior and faster decision-making, better resource management, increased competitive advantage, and lower risks (Parks & Thambusamy, 2017). Investments in BA should result in reduced costs or higher profit, with the effect bigger than the invested amount.

Smaller enterprises are generally more unstable and insufficiently resilient to resist invasive competition. To succeed, they need to manage their business and resources most efficiently, particularly IT-related (Raj, Wong & Beaumont, 2016). However, according to the analyzed studies, small and medium enterprises (SMEs) are hesitant with the adoption of BA and fall behind bigger companies when it comes to capitalizing on the possibilities of BA (Gudfinnsson, 2019). For them, expenses of BA adoption are relatively higher and regulatory influences and demands are smaller compared to bigger enterprises. Bigger companies have a larger demand for BA than small and medium-sized, because of the scale and scope of their business.

Companies that want to incorporate BA in their work confront many difficulties on that road and do not always obtain expected results. Thus, it is crucial to approach carefully to the implementation of these systems (Nunan & Di Domenico, 2013). Companies should make extra effort to ensure the return of their investments. One of the main steps of ensuring that BA efforts will pay off is conducting a readiness assessment. Williams and Williams (2007) have pointed out that BA readiness is a precondition for the success of BA adoption. Readiness for BA represents the extent to which an organization is ready to change in order to maximally utilize the benefits of BA, which usually includes business and technical aspects.

Since SMEs have a significant economic and social function in our environment and represent an essential part of economic development, enhancing the competitiveness of smaller enterprises globally is very important (Llave, 2017). Introducing technical innovations into smaller companies can significantly improve their performance, but with a precondition of ensuring their proper adoption. There is a limited amount of research papers that are focused on analyzing BA adoption and readiness in small organizations, and the majority of BA research studies is related to its implementation in big organizations. Therefore, the purpose of my research is to contribute to the success of BA adoption in small retail companies. The main research question of my master thesis is: “When is a company ready to adopt BA?”

The goals of my master thesis are following:

1. to study the relevant literature related to BA adoption,
2. investigate the main readiness factors for BA adoption,
3. analyse the situation in the selected company,
4. summarize the findings of my research,
5. compare the findings from the case with those from the literature,
6. prepare guidelines for the company, including what they need to do if they want to adopt BA.

In the first chapter of my master thesis, I conducted a literature review where I presented the main benefits of BA adoption, definitions of the main concepts, theories, determinants, and cases of BA adoption. I also summarized the readiness factors from the literature review and provided a framework for readiness assessment. Afterwards, I used that framework for BA readiness assessment in a small retail company in Serbia. In the following chapter, Research Methodology, I presented the research methods used and explained the current situation in the company I analysed. Then, I performed data analysis in the Microsoft Power BI programme, and showed the results to the company’s employees as a representation of the system’s possibilities, since potential usefulness and ease of use were some of the determinants of BA adoption. Afterwards, I conducted an interview and presented the outcomes in the Results chapter. In the Discussion part, I compared my findings with the theory and previous cases, and in the Conclusion, I summarised the main findings of my research. Finally, I added theoretical and practical implications with guidelines for the company, as well as limitations and suggestions for future research.

1 LITERATURE REVIEW

1.1 Business Analytics and Organizational Performance

BA can be defined as “techniques, technologies, systems, practices, methodologies and applications that analyse critical business data to help an enterprise better understand its

business and market and make timely business decisions” (Chen, Chiang & Storey, 2012). Davenport and Harris (2007) defined BA as “the extensive use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to drive choices and actions”. Arnott and Pervan (2014) stated that Davenport's professional article in the Harvard Business Review, as well as the book written in collaboration with Harris were highly significant for making the phrase Business analytics widely popular.

BA has emerged from decision support systems (DSS). There are multiple definitions of DSS, and what they all have in common is the systems' function in the decision-making process, such as improving the process itself and the results (Burstein & Holsapple, 2008). Keen and Morton (1978) emphasized that the purpose of decision support systems is to help management with decision-making processes in semi-structured assignments, reinforce managerial judgment and increase the effectiveness of decision-making, with the use of computers. Fick and Sprague (2013) claimed that managers are turning to information technology as a support as they try to improve the efficiency and effectiveness of their companies. Several forms of analytics could be applied to enhance the decision-making process, including descriptive, predictive and prescriptive analytics (Sharda, Turban & Delen, 2014).

Further development of DSS resulted in its various types such as Group support systems, OLAP, Negotiation support systems, Data warehousing, Business Intelligence and Business Analytics. The demand for enhanced decision-making capability has resulted in the creation of BA (Gibson & Arnott, 2004). At the beginning of the 21st century, the name business analytics was developed to concentrate on the analytical aspect of business intelligence (Chen, Chiang & Storey, 2012).

There are a few differences between BA and other information systems. First of all, usage of BA is voluntary, with more indirect benefits that show in the long run (Popovič, Hackney, Coelho & Jaklič, 2012). Also, BA is mostly used by managers at a higher level of organization, and the data gathered through BA is aggregated at the corporate level, with higher information exchange. Next, the use of BA is typically more exploratory, whereas the use of operational information systems is more exploitative. This implies that IS needs less structured information and processes, while BA needs less structured instructions. Moreover, the emphasis of BA is on the essential data, which can be external or internal, and its usefulness, rather than the technology itself.

BA is considered one of the most significant technological factors for achieving competitive advantage. Adoption of BA can lead to benefits like improved profitability, higher efficiency and reduced costs. (Hejazi, Abdolvand & Harandi, 2016). This technology allows users to rapidly comprehend complex data, allowing them to make better choices and, as a result, fulfil business objectives in a shorter time span (Hočevár & Jaklič, 2010). The main values that BA adoption brings are higher effectiveness of core processes, that further influence overall organizational performance (Williams & Williams, 2004). According to Chen,

Chiang and Storey (2012), BA is widely applied, with the great potential to transform fields such as commerce, politics, science, technology, medicine etc.

Generation of real-time data analysis can be used by many profiles of employees, who can now easily and quickly access relevant data and extrapolate information needed for their assigned responsibilities. Regarding external data, information can be created from engagement with customers, leads, suppliers, rivals, other stakeholders and market research (D'Arconte, 2018). Thanks to the new technology, management is able to make targeted decisions and implement the best methods for attaining corporate goals. This mostly relates to the examination of future trends and the identification of new items, services etc, so that firms are not caught off guard by the unavoidable market changes, but are ready to satisfy consumer demand.

Carver and Ritacco (2006) classified the advantages of BA, as well as the advantages of IT in general, into four groups:

1. Quantifiable benefits – these are measurable benefits, such as saved working time for reports creation.
2. Indirectly quantifiable – can be assessed via indirect evidence, such as customer satisfaction which further leads to higher sales, bigger profit etc.
3. Intangible benefits – such as better communication between the employees, better working conditions and knowledge sharing.
4. Unpredictable benefits – further discoveries made by BA users, which later result in new benefits.

When done correctly, BA could provide information, efficiency, superior and faster decisions, and profit to nearly any business. According to Howard Dresner (2013), the greatest desired goal for BA in SMEs, as well as for large enterprises, is to improve decision-making. The difference is that SMEs prioritize higher revenues and competitive advantage because of BA usage, while bigger companies are more focused on the consequence of enhanced operational efficiency.

In the retail sector, responding on time to changes is crucial for success. BA offers numerous new possibilities to retailers for achieving higher value. Massive amounts of data that are available can be used for customizations, tracking inventory status, supply chain management and demand forecasting (Dekimpe, 2020). In McKinsey's report from June 2011, sixteen potential values of data analysis were identified, divided into five groups - marketing, merchandising, operations, supply chain and new business models. Marketing group includes cross-selling (using information about the customers – their purchasing habits, demographics, location etc. to enhance selling, usually including promotions for complementary items), location-based marketing (targeting buyers who are close to the retail stores), in-store behaviour analysis (tracking buyers' behaviour to modify store layout and shelf positioning), customer micro-segmentation (customization for individual customers),

sentiment analysis (analysing data from social media and responding to people's reactions to campaigns) and enhancing the multichannel consumer experience. Merchandising includes assortment optimization (which products to sell in which stores), pricing optimization (based on historical data and pricing elasticity), and placement and design optimization (for example placement on shelves and design of a web store). Operations include performance transparency (e.g., sales by stores or per employee) and labour inputs optimization (prediction of the necessary workforce). The supply chain includes inventory management (reducing the chance of running out of stock), distribution and logistics optimization, and informing of supplier negotiations. New business models include price comparison services (usually by the third party, between different retailers) and web-based markets.

Bradlow, Gangwar, Kopalle and Voleti (2017) investigated benefits for the retail industry provided by using data analytics, focusing on five main data dimensions: customers, products, time, location, and channels.

1. Customers - monitoring technologies have enabled organizations to transition from aggregate data analysis, used in the days when data was scarce, to individual-level data analyses, which permit considerably more precise targeting (Dekimpe & Hanssens, 2000). The possibility to identify new customers and monitor their transactions over time is very important in retail. Loyalty programs (Kopalle, Sun, Neslin, Sun & Swaminathan, 2012; Stourm, Bradlow & Fader, 2015), which are widely used nowadays, are the most frequent method of collecting data, together with credit cards, IP addresses, and online registration data. Customer information often consists of transaction data from CRM linked to customers, demographic data obtained from credit or loyalty cards, email questionnaires, and in-store information.
2. Products - product information can allow a variety of analyses, such as analyses in the area of brand premiums, or grouping products by their similar characteristics.
3. Time - while previous retailing analyses aggregated the data at a monthly level, now there is a possibility for continuous analysis of information, including customer behaviour, product availability and assortment, etc. Retailers are attempting to determine how offering a lower price or changing the position of a product affects the consumers' behaviour. Furthermore, today's challenges related to product inventory, orders, etc. should not be addressed by historical approach, but by using real-time data that are linked directly to credit cards and CRM systems.
4. Location - The capacity to exploit the customers' position at any point (Larson, Bradlow & Fader, 2005) has created a new channel for merchants, which can further significantly influence the success of marketing.
5. Channels - The number of channels via which customers may receive products and information about that product, form experience and make the purchase has significantly increased in the twenty-first century. As a result, customers are increasingly engaging in 'research shopping,' or obtaining information from one channel and buying from another

(Verhoef, Neslin, & Vroomen, 2007). Recognizing that collecting information and actually buying can occur at separate times and that customers typically want aid in making decisions, companies have begun to experiment with different ideas, such as Showrooming and Webrooming. Gathering consumer's social media information provides new options in demographic and behaviour-based targeting, preference detection, word-of-mouth, recommendation systems, and so on, which increases selling potential. Also, data about location and habits can be collected through downloaded retailer's shopping apps (Bradlow, Gangwar, Kopalle & Voleti, 2017).

Even though several research papers have investigated the benefits of BA, only a small number of studies have explored the benefits of BA for SMEs (Llave, 2017). D'Arconte (2018) states that even small businesses may reap the most significant benefits of BA, at least in a limited form. Hočevár and Jaklič (2010) investigated the possible benefits of BA adoption, and they emphasized that the benefits of implementing BA are frequently bigger than they may seem at the beginning. Some advantages are easy to notice, such as higher report customization and quicker and easier data overview. Other advantages are less evident, and it is hard to establish whether they are the product of BA adoption or other factors. Because of their indirect and prolonged effects on company performance, many of these advantages are frequently difficult to quantify. In the case of Melamin, BA adoption had multiple tangible and intangible benefits. For example, the faster business analysis resulted in higher profit, which came as a result of improved and faster decision-making, faster response to customers' demands which resulted in better customer satisfaction, lower costs because of the time savings and decreased IT staff work activities requiring for report preparation, an increase in market share as a result of the ability to transparently track sales quantities and trends, simpler recognition of locations with lower sales, changes from earlier trends, and similar, which all can be called essential to the organization's survival in a highly competitive market.

BA can certainly enhance a company's performance by promoting innovation, developing new services and products, and improving the decision-making process. Nevertheless, the company needs to fulfil some technological and organizational requirements before the implementation, to exploit all the benefits of the new system (Chen, Chen & Bajwa, 2016). There is a big difference between the potential benefits of BA in retail and reaping those benefits through the system's successful implementation. Also, business intelligence may be costly if the information it delivers is inaccurate or does not meet information demands. Anjariny and Zeki (2013) published in their research that more than fifty per cent of BA projects do not achieve anticipated benefits. Especially smaller retailers, which have limited amounts of resources to invest, have less chance to experience the full benefits of BA (Dekimpe, 2020). According to a survey conducted by MIT Sloan Management Review and the IBM Institute of Business Value (LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011), the most significant barrier to wide analytics adoption is a "lack of understanding of how to use analytics to improve the business". Researchers that focused on BA frequently

offered adoption frameworks and demonstrated maturity levels and adoption theories to help people better grasp the mentioned topic. Some of the researchers, on the other hand, focused on determinants and drivers that influence BA adoption in small and medium enterprises (Llave, 2017).

Since the implementation of BI systems requires high investments, organizations should take extra caution to ensure the return of those investments (Anjariny, Zeki & Hussin, 2012). Companies have to pay special attention to understand all the necessary factors for BA adoption. Assessing readiness is one of the main precaution steps for ensuring proper adoption, and consequently, benefits of BA solutions.

1.2 Business analytics Readiness assessment

BA readiness assessment is generally used to gather information and identify the company's gaps, and accordingly, develop strategies for effective BA adoption that will bring maximum value. It was built on basis of previous data warehouse readiness assessments, with the final goal to achieve higher profit in private companies, and better productivity and service in public companies with usage of BA (Williams & Williams, 2004).

Williams and Williams (2004) pointed out that BA readiness assessment is a tool that can assist in overcoming the constraints of traditional development methodologies and architectures. They defined BA readiness as a state in which a company:

1. Comprehends and recognizes the critical prerequisites for utilizing information, analytical tools and systematic decision-making to enhance business processes that generate revenue and increase productivity,
2. Has reached widespread agreement among its top executives to modify core management and business processes and
3. Has proper resources (financial, technical, managerial) to implement programs that transform core management and business processes in order to utilize BA.

BA adoption readiness is crucial for the success of BA implementation in a company (Hejazi, Abdolvand, & Harandi, 2016). This way additional costs and failure can be prevented. It should be determined at the beginning how BA business value is created and manage factors (business and IT) necessary for its fulfilment (Williams & Williams, 2004). For that purpose, various models were developed, to help companies understand their strengths and weaknesses (Anjariny, Zeki & Hussin, 2012).

Readiness factors are elements that determine whether the investments will pay off. These factors can be seen as barriers to BA adoption, and consequently for extracting the benefits provided by the new technology. A readiness assessment should be conducted before BA adoption, and we should position the organization relating these factors in order to estimate how much the company can adjust. If done correctly, it will result in a return on investments

and reduce the risks. We should take into consideration that a perfect result is not possible. Every organization has strengths and weaknesses, and some areas are easier to correct than others (e.g., technical readiness is easier to achieve than cultural).

Readiness factors in the research papers are usually presented together with the critical success factors. Anjariny, Zeki and Hussin (2012) emphasized that critical success factors have a crucial role in constructing any model designed to assess the readiness for BA systems. Some other terms that refer to the prerequisites for BA adoption are Key Success Factors (KSFs), Implementation Success Factors (ISFs), Success Factors (SFs), Implementation Factors (IFs) and Readiness Factors (RFs)

Critical Success Factor is a crucial element or action necessary for an organization's success. In the context of BA, CSFs are determinants that lead to the successful adoption and implementation of BA. Hidayanto, Kristianto and Shihab (2012) define CSFs as components that are required for an organization or initiative to fulfil its objective. They proposed a methodology for measuring BA readiness based on CSFs, and the framework focuses on conditions that should be fulfilled before the implementation and identify possible gaps. Critical success factors have been used to measure BA readiness, but they may also be used to learn from past BA implementations and highlight key variables to continue with the deployment. The use of CSFs to assess BA readiness reveals the tight link that exists between critical success factors and readiness factors (Gudfinnsson, 2019).

Readiness evaluations are usually focused on the demands of bigger organizations, but they do give critical insight into what small and medium enterprises should focus on (Gudfinnsson, 2019). Even though there haven't been many studies on assessing BI readiness in SMEs, researchers have discovered several variables impacting BA adoption, and have also proposed suggestions on how SMEs may enhance their BA usage by outlining readiness factors and critical success factors (CSFs).

1.3 Criteria for Assessing Readiness

One of the first research papers in the area of BA readiness was written by Williams and Williams (2004), who took a business-centered approach, identifying seven factors for assessing BA adoption readiness: strategic alignment between IT and business, continuous process improvement culture, culture regarding the use of information and analytics, BA portfolio management, decision process engineering culture, business and IT partnership and finally, technical readiness for BA.

Strategic alignment: According to Williams and Williams (2004), business strategies and goals, key processes and BA applications should be strategically aligned. In this context strategic alignment as a BA adoption factor happens when:

1. Business strategies and business processes are consistent and aligned. This can be accomplished by strategic planning or strategy mapping mechanisms.
2. The aim of BA initiatives is to enhance key processes that generate profit or improve productivity and service (depending on whether they are applied in private or public sector organizations).
3. IT strategies, IT organization and infrastructure support BA initiatives

Continuous process improvement culture: Changing business processes to be in accordance with the adoption of BA is a precondition for organizational success and a successful BA initiative. Companies that accepted continuous process improvement culture (especially regarding the use of IT) are more likely to perform necessary changes. If process improvements are required to fully utilize BA but the company does not implement them, the invested money will be lost. It is important to assess whether the organization is ready to handle process changes that need to be done in order to grasp BA adoption benefits and prepare plans to manage the risks if not.

Culture of using information and analytics: enterprises that accept the use of information and analytical applications to upgrade their business are more successful in utilizing investments in BA. The preparedness of companies to employ analytical tools to enhance their performance varies. This is a part of corporate culture, and it is impacted by their business environment. For instance, companies with large fixed costs use highly advanced monetization strategies on a daily basis to ensure they generate the highest achievable profit under specific conditions. Since their operating environment requires the usage of BA applications, their organizational culture usually supports the implementation of new BA applications. Contrarily, in some top businesses where the prevailing operating style was defined by a shortage of data and analytics, decisions were made intuitively instead based on information.

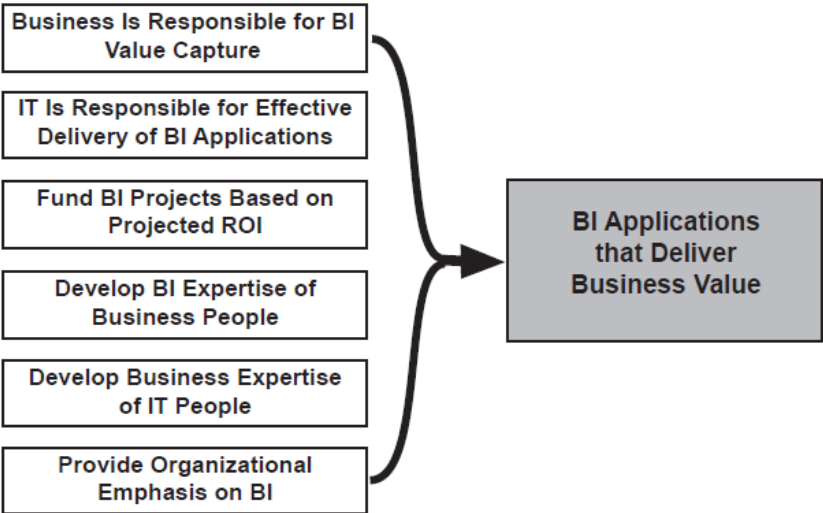
BA portfolio management: Wide variety of BA solutions may help the company's functional divisions to perform better. Enterprises that have conducted a thorough analysis of the main BA possibilities in multiple areas such as sales, marketing, manufacturing etc. can handle BA projects as a portfolio of investments. Ones that take a portfolio approach to BA initiatives demonstrate a stronger commitment to new technology and are more prepared to fully utilize the benefits from BA. In a capital-constrained environment, refusing to manage BA projects as a portfolio can result in supporting one BA project at the expense of another that could provide a better return on investment.

Decision process engineering culture the authors used the term “decision process engineering culture” for applying structured decision-making to improve the effectiveness of specific decisions that companies confront often or relatively often. Organizations that use structured decision-making are better at deploying BA systems, which later provides benefits to the company. Structured decision making can include the utilization of information, BA applications, and quantitative approaches.

Technical readiness: the technological capacity to provide the information and analytical tools that enable the implementation of BA is a crucial prerequisite for realizing all its benefits. There is a lot of information available on how to accomplish this, however, some companies are far more adept compared to others in terms of planning, creating, deploying, managing, and maintaining the necessary technological infrastructure to enable data warehouse and BA.

Regarding business and IT partnership, generating business value with BA usage necessitates a strong connection between business and IT, as well as ongoing business engagement. Companies that have successfully leveraged IT to enhance their performance will be better prepared to use BA to produce business value than those whose practices do not foster such collaboration. This kind of partnership includes regular meetings between the departments, steering committees, and communication mechanisms. Elements of effective business and IT partnership are shown in the Figure 1 below.

Figure 1: Elements of Effective IT and Business Partnership



Source: Williams and Williams (2004).

Hidayanto, Kristianto and Shihab (2012) developed a model for readiness level assessment for SMEs based primarily on the work of Atre (2003), Williams and Williams (2004), and William and Koronios (2010). The framework was divided into three sections: organizational, process, and technology, with nine organizational, four process, and five technological factors. The factors adopted from Williams and Williams (2004) are: strategic alignment between business and IT, effective business/IT partnership, BA portfolio management, continuous process improvement culture, culture regarding the use of information and analytical applications and decision process engineering culture. The rest of the variables that are estimated to have a substantial influence on BA deployment are:

1. Management support and sponsorship: this factor has been recognized as the most critical for BA implementation (William & Koronios, 2010). Constant support from corporate leaders makes it easier to obtain the necessary operational resources.
2. A strategic business vision and an established business case are required to properly guide the adoption of BA. The business case has to be coordinated with the long-term, strategic vision in order to satisfy the company goals and requirements. A strategic vision is required to guide the implementation of BA and the strategic vision is not fully understood, the BA adoption will face struggles. (William & Koronios, 2010).
3. Cross-Organizational Cooperation: When it comes to BA, all the departments should work together since BA demands sharing knowledge at all levels. A company must foster a collaborative culture throughout the organization, in which everyone understands and contributes to the strategic objective (Atre, 2003).
4. Business-centric championship and well-balanced team structure: a champion with proven expertise can anticipate organizational difficulties and adjust appropriately. The champion should approach the BA system adoption primarily from a strategic and organizational standpoint (instead of technical). Also, the structure and abilities of a BA team have a significant impact on the system's deployment. The team should be cross-functional, with both technical and business members. (William & Koronios, 2010).
5. Skilled Team Members Availability: a team that lacks practical BA implementation knowledge probably will not achieve expected outcomes from the first attempt. BA projects have tight schedules and short delivery cycles, so working with an incompetent team without enough experience should be prevented (Atre, 2003).
6. Business-oriented and Iterative Development Methodology: this enables team members to focus on the most promising areas for development. Detailed scoping and planning drives agility and responsiveness to new requirements while staying within the time and resource limits. (William & Koronios, 2010).
7. User-oriented change management: Improved user engagement in the change process may improve communication and expressing customer demands, which leads to better satisfaction of their needs (William & Koronios, 2010).
8. Scalable and flexible technical framework: The BA system's technological framework should be scalable and flexible in accordance with constantly changing business needs (William & Koronios, 2010).
9. Sustainable data quality and credibility: The quality of data is critical for effective BA implementation (William & Koronios, 2010).
10. Importance of Metadata: Clean data is useless to its users unless it is contextualized. BA systems must proactively build and maintain the meaning of data. Meta-data management is critical for BA initiatives (Atre, 2003).
11. BI and Data Warehouse Technical Readiness: Already mentioned by Williams and Williams (2004), the technical preparedness of a company includes network infrastructure, availability of appropriate equipment for data warehouse deployment, and analytical tools.

12. The Silver Bullet Syndrome: there is no technology that can solve all problems companies face and guarantee successful BA adoption. Frequently, BA is adopted in different phases in different departments, which can increase the number of tools used. More tools increase complexity in an organization. Thus, BA teams should seek a minimal number of tools (Atre, 2003).

Boonsiritomachai, McGrath and Burgess (2014) have been working on establishing the framework for BI adoption, which resulted in naming six main determinants – innovativeness of the manager and his/her understanding of the benefits brought by innovation, perceived usefulness, organizational financial and technological resources, competitive pressure and vendor selection.

Anjariny and Zeki (2013) conducted research with the purpose to investigate and measure the importance of readiness factors for BA in Malaysian organizations. They developed a questionnaire for IT and business managers and later added open-ended questions so that participants could add or dismiss factors. The results showed that all below displayed dimensions are relevant for the model (Figure 2).

Figure 2: Success and Readiness Factors in hypothesized model of Anjariny, Zeki and Hussin

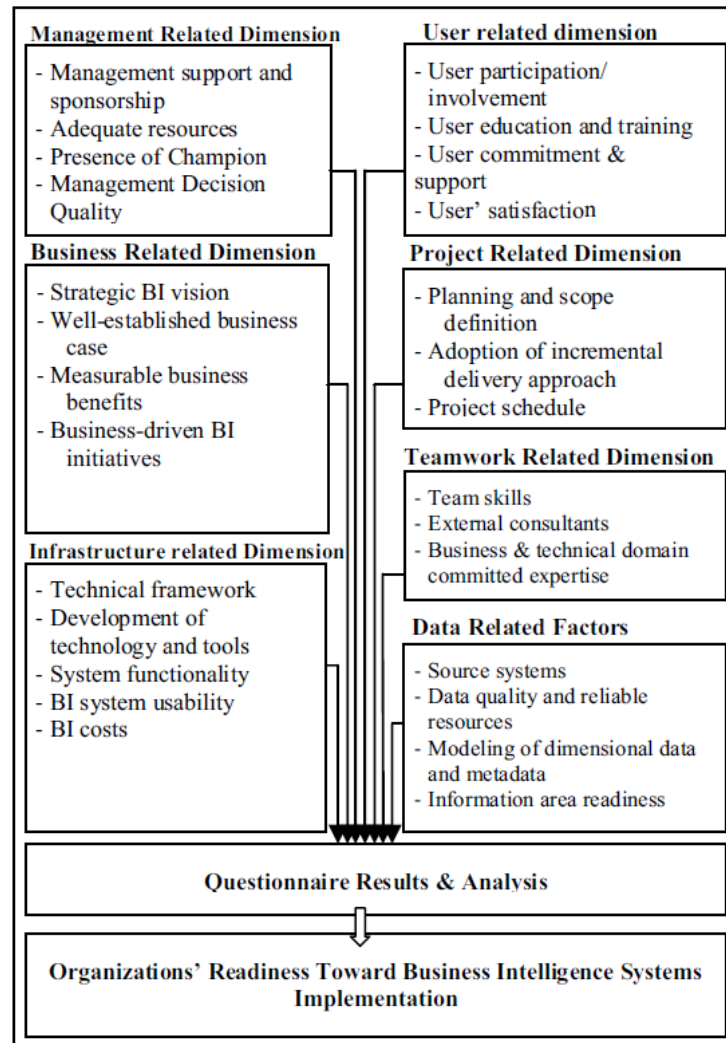
Dimension
Management related Dimension
User Related factors
Teamwork Related Dimension
Project Related Dimension
Data Related Factors
Business Related Dimension
Infrastructure related Dimension

Source: Anjariny, Zeki and Hussin (2012).

Hejazi, Abdolvand, and Harandi (2016) tried to identify organizational readiness factors for the adoption of BA in three types of organizations – educational, commerce and IT. They based their model on research papers of Anjariny, Zeki and Hussin (2012) and Anjariny and Zeki (2014). Four main groups of factors – individual, culture, management, and strategy were included. The research identified 18 indicators and measured their effect on BA readiness – support of change and innovations, knowledge, an environment that allows changes, loyalty, commitment, partnership, the existence of a business plan, satisfaction, resource allocation, learning from failure, continuous process improvement, data warehouse and analytical skills, using information and analysis applications, measuring performance

and knowledge-based decision making (Figure 3). The data, which was gathered by a questionnaire, showed that learning from failure, the environment, partnership, commitment, satisfaction and business plan were not statistically relevant, so they were excluded from the model. They stressed out that many companies take only technical aspects into consideration when adopting BA, but process, culture and management should be considered as well. These factors are considered as most difficult to change.

Figure 3: Success and Readiness Factors in hypothesized model of Anjariny, Zeki and Hussin



Source: Anjariny, Zeki & Hussin (2012).

Ariyachandra and Watson (2006) examined the CSFs for BA adoption and discovered that the four most important group of factors that influence whether a company's BA adoption efforts are effective are: information quality (including information accuracy, completeness and consistency of data), system quality (including system flexibility, integration and scalability), individual impacts, and organizational impacts. Individual impacts were rapid and simple access to data and data security. Organizational impacts refer to utilization of BA, process improvements, increased ROI, greater communication and cooperation across

the organization's divisions and accomplished business objectives. (Ariyachandra & Watson, 2006).

Gibson and Arnott (2004) analysed BA adoption in small companies, and especially focused on identifying necessary factors for its adoption. Small companies' operations and decision-making are substantially different from those of bigger enterprises. Small businesses are not so resilient towards economic uncertainty and consequently have to put additional effort to become more efficient. Given that small companies have restricted financing resources, it is obvious they don't have the same possibilities regarding data-driven decision making as bigger organizations. Gibson and Arnott (2004) pinpointed ten factors:

1. Innovativeness of the manager or owner - small organizations are usually centralized, and owners or managers make most important decisions, including adoption of new technology. Consequently, BA adoption depends on their opinion and innovativeness.
2. Manager knowledge and attitude towards BA – similar to the previous factor, manager's opinion on significant topics such as technology adoption is extremely important, and their knowledge of information systems is a significant contributor to adoption of BA. Innovative managers, with higher technical skills are more likely to adopt BA.
3. Company's size – there is a bigger chance for adopting BA as the small company expands. This can be explained as the company's size increases, so does the amount the work, as well as access to funds and IT infrastructure.
4. Access to capital – scarcity of resources can result in lack of technological knowledge in small enterprises.
5. Influence of major customers – smaller organizations are more sensitive to external pressures, such as regulations, tax changes and customer demand.
6. Ability to implement BA - small firms, in general, experience lack of resources in comparison to large enterprises. Because small businesses frequently do not have the possibility to create enough financial resources for big investments, resource poverty has important consequences for their ability to embrace new technology.
7. Knowledge about BA and information systems – small companies can struggle with hiring experts with appropriate skills for BA implementation because of the lack of resources. This can further lead to inferior solutions.
8. IS strategy – small enterprises often do not have strategic plans related to IT adoption. Technological investment assessments must be tightly connected with the entire company's IT strategy.
9. IT skills – frequently, there is a necessity for general IT training before gaining specific IT knowledge such as BA.
10. Emphasis on automation - small companies are more focused on automating tasks with technology than gain information.

Chen, Chen and Bajwa (2016) pointed out that internal capabilities determine organizational preparedness for profitable BA projects. Therefore, organizations should analyse their infrastructure, culture, people and other factors that could influence system adoption. Also,

checking if their IT infrastructure and technology is capable of meeting the demands of BA implementation is necessary.

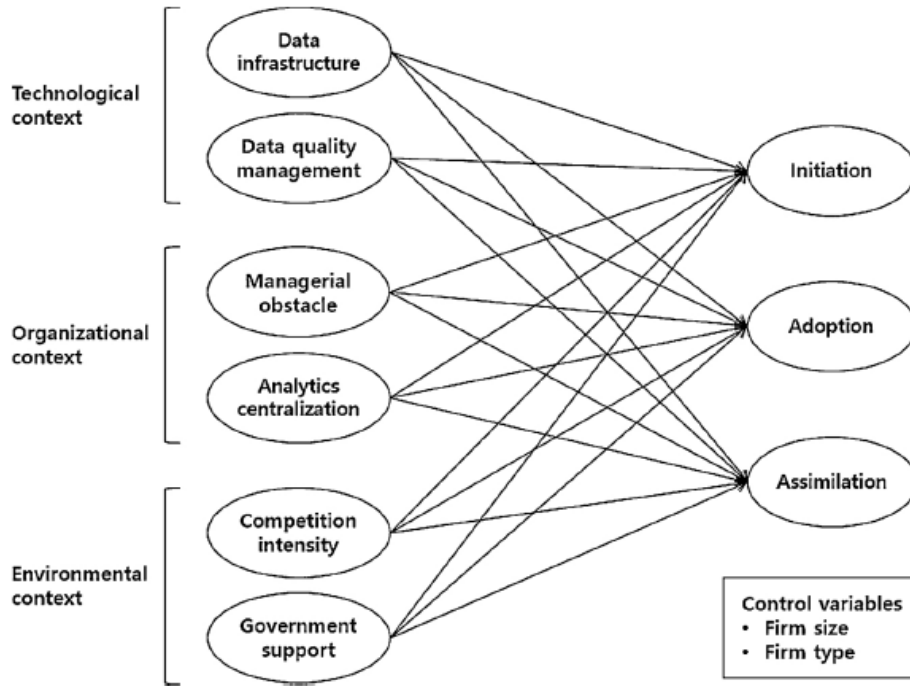
Pedro, Brown, and Hart (2019) also investigated competencies that are required for organizations in order to attain BA readiness. They proposed seven primary concepts crucial for an organization's readiness:

1. Alignment to company strategy (including business needs and strategic alignment)
2. Powerful, dedicated sponsorship (strong leadership and support)
3. A data-driven decision-making culture
4. Analytical skills (technological and business skills)
5. Good data infrastructure
6. The proper analytical tools (BA, reporting and visualization tools)
7. Legal compliance for data protection.

Nam, Lee and Lee (2019) aimed to provide suggestions for BA adoption by combining theoretical background and empirical analysis. They aimed to identify factors for BA adoption, and present how their significance varies depending on different stages of this process. In this study, the BA adoption process was divided into three phases – initiation, adoption and assimilation (Figure 4). The division of the process was performed for a better understanding of its enablers, even though the majority of studies that analysed technological adoptions considered it as a one stage process. During the initiation stage, organizations evaluate possible benefits from BA adoption. During the adoption stage, they decide whether they will be using BA solutions, and the assimilation stage refers to using new technology as a routine across the company and its processes. The BA initiation phase was assessed by how the organization evaluated the prospective advantages of BA. Cost reduction, market growth, capturing new business possibilities, and strengthening connections with customers and business partners were all used for this purpose. In order to assess the second, adoption phase, the main criteria were whether the organisation had employed similar technology in five areas: data, text, web, network and mobile analytics. The assimilation phase was assessed by the volume, diversity and depth of BA usage.

The outcome of their research demonstrate that technological factors are the most relevant for all phases of BA adoption. Data infrastructure and data quality management both have a substantial impact on the BA initiation, adoption, and assimilation processes, especially data infrastructure. Data infrastructure is more significant than data quality management in the first two phases of BA adoption. As a result, senior management should prioritize data-related infrastructure in the initiation and adoption phases. In the assimilation phase, data quality management is a lot more significant than data infrastructure. The subsequent stages of BA adoption - adoption and assimilation, are influenced by organizational determinants, such as management obstacles and centralization, but the environmental components only have a beneficial effect on initiation.

Figure 4: Success and Readiness Factors in hypothesized model of Nam, Lee and Lee



Source: Nam, Lee & Lee (2019).

There are two main theories regarding information system adoption – Diffusion of innovation (DOI) and the Technology, Organization and Environment (TOE) framework (Chong, Ooi, Lin & Raman, 2009). Roger’s Diffusion of innovation theory (1995) identifies three main groups of factors that influence the IT adoption process – leader characteristics (his perspective of changes), organizational structure, and the organization’s external characteristic (Puklavec, Oliveira & Popovič, 2014). The TOE framework (Tornatzky & Fleischer, 1990) observes BA adoption from three dimensions: the external environment, organization, and technology. Technological context of TOE framework includes data-related factors like data quality and infrastructure. Organizational factors include managerial obstacles and analytics centralization, while environmental factors refer to competition intensity and government subsidies (Nam, Lee & Lee, 2019).

Some researchers, such as Hatta et. al. (2015) and Boonsiritomachai, McGrath, and Burgess (2014) introduced the fourth dimension to the TOE framework - manager's innovativeness. In their classification, the technological dimension comprises internal and external technologies, procedures and equipment. The organizational context includes factors such as the company's size, structure and team members. The environmental context considers rivals and the government support, while the manager's innovativeness context considers management characteristics, decision-making and innovativeness in adopting IT (Hatta et al., 2015).

Another model, based on the TOE framework and created in the context of IT adoption in small and medium enterprises is the Iacovou model (Iacovou, Benbasat, & Dexter, 1995). The Iacovou model proposes three groups of factors typical for SMEs: organizational preparedness (financial and technological, taking into consideration lack of resources), perceived benefits and external pressures (competition, business partners) (Iacovou, Benbasat, & Dexter, 1995). In the following chapters of my master thesis, I will elaborate on each group of factors from the TOE framework.

1.3.1 Technological Context

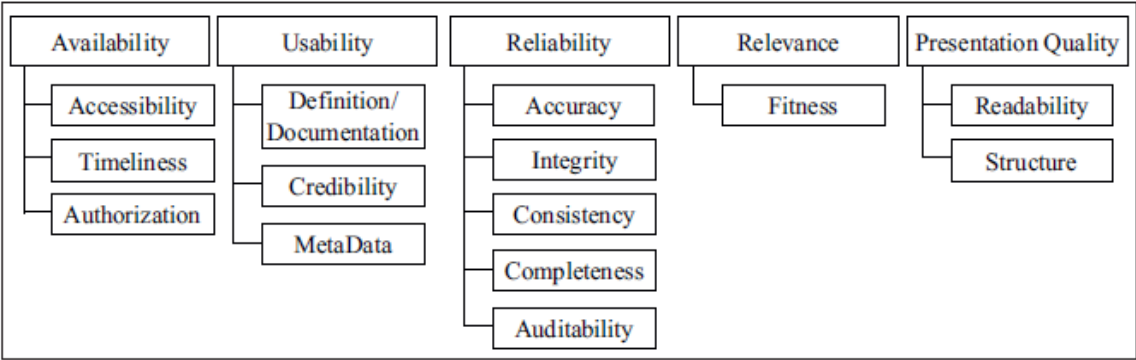
The modern world implies the existence of huge amounts of structured and unstructured data. As a result, companies require data-related infrastructure like data collecting, storage and processing (Alharthi, Krotov & Bowman, 2017; Klievink, Romijn, Cunningham & de Bruijn, 2017). Collection of data and developed information technology infrastructure are prerequisites for BA adoption (Sabherwal & Bacerra-Fernandez, 2010). Lai, Sun and Ren (2018) confirmed in their research that solid IT infrastructure is one of the most important factors for BA adoption, as it serves as a technological foundation for the effective launch of BA. The IT infrastructure affects the degree of readiness for the company's acceptance and assimilation of innovations, whilst a lack of needed IT infrastructure may become an obstacle to embracing innovation (Alharthi, Krotov & Bowman, 2017; Taylor & Todd, 1995). Data infrastructure, in particular, is regarded as one of the most important factors for BA adoption and deployment, for enhancing business activities (Aydiner, Tatoglu, Bayraktar, Zaim & Delen, 2019; Kim & Park, 2017; Wamba, Gunasekaran, Akter, Ren, Dubey & Childe, 2017). An aggregated index on whether the business has utilized data-related IT infrastructures in three areas - data collecting, data storage and data processing technologies, was used to assess data infrastructure. Data quality management entails actions to improve data consistency and completeness (Kwon, Lee & Shin, 2014).

Data quality management supports the enforcement of data standards in a company, and the prevention of data mistakes, resulting in improved data quality (Ramamurthy, Sen, & Sinha, 2008). Poor data quality is a key obstacle to efficient BA implementation due to a variety of issues such as inadequate system design, data entry mistakes, and the subjective assessment of a data operator (Strong, Lee, & Wang, 1997). Insufficient data quality can lead to poor decision-making and organizational performance, higher operational expenses, and lower customer satisfaction (Ballou, Madnick, & Wang, 2003; Kahn, Strong, & Wang, 2002; Redman, 1998).

According to Cai and Zhu (2015), the prerequisite for understanding and utilizing BA, as well as ensuring the value of the data is high-quality data. The data quality standard is based on five dimensions: availability, reliability, usability, relevance, and presentation quality (Figure 5).

Availability presents how easy it is for users to obtain the data and related information, and consists of three parts: accessibility, authorization, and timeliness. Usability refers to how well the data meet the needs of its users, and includes data documentation, reliability, and meta data. The term "reliability" shows whether users can trust the data; it includes the elements of accuracy, completeness, consistency, adequacy and auditability. Relevance describes the extent of correlation between data content and users' demands. Presentation represents a correct data description method that allows users to fully comprehend the data. It has two dimensions: readability and structure.

Figure 5: Data quality framework by Cai and Zhu



Source: Cai & Zhu (2015).

The research by Nam, Lee and Lee (2019), which mainly focused on examining factors from the “TOE” framework and their relative influence on different phases of BA adoption, showed that data-related technological context factors - data infrastructure, and data quality are the most important factors in all phases of BA adoption. Williams and Williams (2004) also included technical readiness for BA as one of the main factors for BA adoption. According to them, the technical capability to supply the information and analytical applications that constitute BA is a crucial prerequisite for realizing the benefits of BA.

According to Chen, Chen and Bajwa (2016), information quality is a critical component that affects the success of BA adoption. The maturity of BA systems will have a direct influence on the quality of information provided by the system. Thus, in this study, system quality is considered as a technical factor that affects BA system performance, while information quality is a measure of successful BA implementation. According to their research, technological factors that influence BA adoption are data availability, data quality, analytical capability, and the ease of use of BA. The extent to which data relevant for generating desired information is available can be defined as data availability. The robustness of loading and cleansing of data can be reflected in data quality. The ease of use of information technology is universally acknowledged as a critical component in the adoption of new technology. It will influence users' willingness to use the information to make decisions.

Puklavec, Oliveira and Popovič (2014) also aimed to gain better knowledge about BA adoption in small and medium enterprises. They performed an evaluation of adoption factors, so they could determine whether the factors vary compared to big organizations. Among technological determinants, Puklavec, Oliveira and Popovič (2014) distinguished two main groups - innovation and readiness factors. Innovation factors investigate BA features that have an impact on its adoption - perceived ease of use and complexity (which illustrate how innovation is viewed as somewhat difficult to understand and apply), perceived benefits, strategic values and relative advantage, cost of the innovation and perceived risks and process compatibility. The cost of IT remains a significant barrier to adoption, particularly for small enterprises which should weigh the cost vs the advantages before adopting new technology. Process compatibility underlines the extent to which innovations are seen as being compatible with current procedures for carrying out their goals.

The other group, technological readiness, includes standards uncertainty (difficulty to predict properly whether innovation and related technologies will be stable in the future and capable of delivering the desired results), availability of external technologies, how current technology matches the company's socioeconomic system, technology infrastructure, and technology readiness. Also, technology integration is marked as important, and it represents the degree of interconnection between information systems and databases within the organization, and those outside the organization, derived from suppliers' databases. The trialability can be perceived as significant, as the extent to which technological innovation (in this case BA) can be tested before usage. The results of this study showed that technical factors are identified as crucial. Among the key factors, their findings highlight the anticipated benefits and strategic value of BA, related expenses, and whether the BA solution is included in an ERP. The last factor, however, is not mentioned in previous studies (was not confirmed in other research papers), thus cannot be taken as a rule for BA adoption.

Raj, Wong and Beaumont (2016) analysed BA adoption in SMEs and the obstacles companies face, especially from the technical point of view. They pointed out that big organizations with a larger budget may acquire one of the many BA systems offered by a prominent provider, which can involve personnel training and support, or even hire specialized staff to deploy and support the system. SMEs, on the other hand, will probably not be able to purchase costly BA system package, and the capabilities of such systems are likely to surpass their demands. Several variables influence SMEs' plans to implement BA solutions:

1. BA solutions are frequently costly.
2. While commercial BA solutions are available, the learning curve for non-technical users is frequently high. Thus, for SMEs, it is critical that an IT system be user-friendly.
3. Hosting a BA solution necessitates the use of expensive hardware infrastructure.
4. SMEs frequently don't have enough in-depth knowledge about BA solutions required to pick the most suitable one for meeting the demands of the organization.

5. Creating BA necessitates a decent comprehension of database modelling and data warehousing. Such technical knowledge is not always easily available in a majority of SMEs.

Nevertheless, BA vendors have recently created BA components that can be easily incorporated. This significantly decreases the cost of implementing BA. However, a viable approach for integrating BA components within the company's current system must still be identified in order to put BA into action (Raj, Wong & Beaumont, 2016). Software as a Service (a cloud-based software program) might be the solution, and extremely useful to SMEs because it is both cost-effective and reasonably simple to adopt. In this case, companies pay regular fees to obtain access to the program over the Internet rather than acquiring the software application from a vendor and installing it on their premises. Though the primary problem with adopting a cloud-based service is the security, privacy, and ownership of data

1.3.2 Organizational Context

The organizational context in the TOE framework includes managerial obstacles and analytics centralization factors (Nam, Lee & Lee, 2019). Managerial obstacles represent serious impediments to BA adoption. They include a shortage of managerial skills and support for BA adoption, together with cultural obstacles (Zhu, Kraemer & Xu, 2006). Managerial obstacles can significantly slow down the BA adoption process since it should be initiated by top management. Resistance to change can arise from managerial obstacles in organizations. Furthermore, if top managers do not perceive the benefits of new technologies to their business, the chances of adopting BA are a lot smaller (Shukla & Mattar, 2019). Managerial and cultural obstacles are, in fact, more common than technological (Davenport, 2014; LaValle et al., 2011).

Organizational structure, or decision-making structure, can be centralized or decentralized. Centralization is one of the internal company's features that represents the degree to which the influence and decision-making in a system are given to relatively few persons (Rogers, 1995). Nam, Lee and Lee (2019) explained that decentralization in organizations indicates higher involvement in decision-making, bigger autonomy, and better communication and information flows. Consequently, their hypothesis was that decentralization is positively correlated with the initiation and assimilation stages of the adoption process. On the other hand, in the adoption phase, centralization can help by decreasing misunderstandings and conflicts. During BA adoption, in centralized organizations, there is usually one analytics department that has concentrated power to make decisions that apply to the whole organization, including the adoption of BA, which accelerates BA adoption. Decentralized decision-making implies that organizations have multiple analytics teams that are focused on their sectors' demands and find suitable technology faster and more easily. Results of their study showed that managerial obstacles have a negative impact on the adoption and

assimilation phases of the BA adoption process, while it does not have a significant influence on the initiation phase. Cultural and managerial climate has a great impact on BA adoption and assimilation. Analytics centralization slows down the assimilation of BA, probably because if there is only one analytics department, it will be overwhelmed with tasks and will not handle the adoption process efficiently. While managerial obstacles are highly significant for earlier stages of BA adoption, analytics centralization, which is also considered part of organizational context, is relevant only in the later phases. This implies that importance of organizational factors grows as the adoption stage continues.

Alharthi, Krotov and Bowman (2017) emphasized the importance of culture as well for organizational attitude towards BA. For instance, data-directed decision-making leads to BA adoption, while lacking management support and not enough reliance on data inhibits BA adoption.

Hejazi, Abdolvand, and Harandi (2016) stated that organizational improvement culture, which is one of the BA readiness factors, is characterized by regular process improvements. Organizations that have this type of culture are suitable for technological changes. Companies opposed to changes are less likely to accept new technologies such as BA. Frequently, the reluctances come from the lack of management support, and both culture and management factors are proved to be significant for BA readiness in IT organizations. However, culture was negatively correlated with organizational readiness for BA adoption in IT organizations, which was explained by insufficient involvement and cooperation. Individual factors (BA skills and knowledge) had positive effects on educational and commercial organizations. Strategy (continuous process improvement and data-driven decision-making) was proven significant in educational organizations. Based on the fact that different hypotheses were accepted in different types of organizations (their field of work and size), non-IT companies should particularly pay attention to their workers and their skills.

Chen (2016) also pointed out that the success of a BA system is heavily influenced by organizational factors. Their main hypotheses regarding organizational factors are that a data-driven organizational culture, BA compatibility with the organizational process and their needs, as well as organizational maturity will positively impact BA success. Regarding organizational culture, users are more likely to utilize a BA system if their business has a culture that promotes data-driven choices. They defined compatibility as “the degree to which the innovation is compatible with the adopter’s previous practices and current needs”. The maturity model evaluates a company's BA maturity across five dimensions: infrastructure, organization, data management, analytics, and governance. IT and business departments in a more developed BA organization share the same views and are more likely to collaborate to provide greater support, advice, and rewards for workers to use BA.

Hočevar and Jaklič (2010) emphasized that IT investments should be in accordance with the organization's strategic goals. This implies that investments in current information

technology should be an important element of the business's strategy, and it should assist the organization in achieving its objectives. Executives, together with the IT sector, should make an effort to provide this scenario.

Puklavec, Oliveira and Popovič (2014) conducted research related to analytics adoption in SMEs and grouped organizational factors into five categories:

Company characteristics – for example, type of business and products, company size (measured by the number of employees), age of the company (businesses that have been in the industry for a longer period of time have more experience with the technology needed), presence on the global market, etc. The reason why the global dimension was included was that global companies aim to reduce costs caused by adapting to heterogeneous markets, and one of the ways is by adopting new technologies. The same applies to producing heterogeneous products.

Collaboration – internal procedures and communication methods used by firms to transmit knowledge and encourage IT adoption can be key adoption determinants. On the other hand, conflicts, or disagreements within the company, or simply lack of communication skills can significantly slow down the adoption of technological innovations. Social networks or linking structures represent the extent to which interpersonal networks connect the units. The more sharing of information is present at the company, the bigger the chance is to accept innovations and new products. Links can be between companies that belong to the same or different industries, and between the staff. The skills of the Project team and User participation are one of the organizational factors as well.

Features of the company - represent an important group of factors for IT adoption, such as company culture and absorptive capacity. Absorptive capacity is stakeholders' ability to use the applicable knowledge. The innovativeness of a company can be explained as their extent of broad-mindedness for accepting new concepts and ideas. Also, IT expertise may encourage the acceptance of new technology and result in widespread IT adoption. On the other hand, contentment with the existing information system is one of the inhibitors, since companies that are satisfied with their current system are less likely to experiment with the adoption of new technology. System openness and willingness to gain IT-related knowledge are named as organizational factors as well.

Management – one of the contributors to innovation adoption. A leader's attitude regarding changes is especially important, together with centralization, formalization (the extent to which companies encourage their members to adhere to established rules and procedures), management support, complexity and perceived obstacles (lack of management skills). Risk propensity as a factor represents a manager's persistent bias to choose or avoid uncertainties. It indicates how ready a company is to take chances. Power relationships are defined as potential conflicts between company management that may arise throughout the adoption process due to differing viewpoints on duties and obligations, priorities, and so on. Electing

project champion, one of the top managers who will advocate innovation throughout the organization is also one of the contributors of successful innovation adoption.

Resources – one of the main factors is the number of resources available to the company, also referred to as »slack«. Among company resources related to BA adoption, we also include technological expertise, size of IT department, organizational readiness and data environment. The scale of the IT department is closely tied to the time and effort required to implement new technology. Companies that lack IT knowledge can be uninformed of emerging technological innovations, or simply don't want to take chances with adopting these advancements. A poorly managed data environment is prone to issues with quality, consistency, safety, availability, accuracy, and standardization.

The results of the study show that a company's internal characteristics have the greatest impact on BA adoption. The findings indicate that adoption of BA in small and medium enterprises is primarily induced by management support, the existence of a project champion, organizational culture, adequate data environment, and other organizational characteristics and features, but also by expectations of the new technology, such as expected benefits and strategic value, as well as anticipated costs.

1.3.3 Environmental Context

The environmental context of the “TOE” framework by Nam, Lee and Lee (2019) includes competition intensity and government support. Competition is one of Porter’s five forces and has an essential role in accepting new technologies. Competition could push companies to adopt technological innovations such as BA so they can remain competitive (Zhu, Kraemer & Dedrick, 2004., Nam, Lee & Lee, 2019). BA has evolved into a critical approach for businesses to surpass their rivals by making decisions based on data, forecasting market trends and consequently adapting company strategy (Davenport, 2006). When a company is under pressure because their rivals are using BA, they will adopt and implement new technology in order to maintain their competitiveness (Lai, Sun & Ren, 2018). On the other hand, competition can also prevent successful BA implementation since enterprises under intense competitive pressure do not gain the essential knowledge and abilities to integrate new technology (Fichman & Kemerer, 1999).

Government support can influence the adoption of BA through legislation and incentives. It can affect the innovation diffusion process by adopting particular actions to enhance or reduce earnings, such as raising or lowering taxes and changing the environment in which they are generated (Williamson, 1980). According to Zhu, Kraemer and Xu (2006), government support is more significant in developing economies than in developed ones.

In the research by Nam, Lee and Lee (2019) the degree of rivalry among companies, the influence of substitutable products and services, how easily customers can shift to a competitor, and price competition in the business were used to determine the intensity of

competition. Four elements were used to assess the government's influence - incentives for using BA, open data and the ability to learn about the technology, skills that the government has provided, and the development of legislation and policy linked to BA.

The study by Nam, Lee and Lee (2019) confirmed that competition has a strong, positive effect on the initiation phase of BA adoption since firms believe it would provide them with a competitive advantage. On the other hand, this does not apply to other phases of the BA adoption process. This can be interpreted that organizations want to learn more about BA adoption from competitors before moving to the next phase of adoption. Also, when BA adoption is already initiated, its future path depends on internal factors. Government support does not have a statistical correlation with any of the above-mentioned adoption phases.

Puklavec, Oliveira and Popovič (2014) organized environmental context factors into eight categories:

1. Linked firms - vertical connections to associated companies which can be relevant when the parent company utilizes its capacities to experiment with new technologies and then transmit them to subsidiaries, or it may even force its subsidiaries to adopt them.
2. Competitors – the pressure from competition to embrace an invention. Intense rivalry can force a company to search for new methods of carrying out business activities, while mimetic tendencies can lead a company to alter over time and be more like other companies in its surroundings.
3. Customers – clients demand, and companies' aim to deliver better customer service through embracing new technologies.
4. Industry and market – this group of factors include the complexity of the market and industry pressures, which are connected to attempts of organizations within the industry to establish norms related to innovation and drive adoption of industry trends which can further push companies to accept innovation same as the competition.
5. Partners – this group of factors refer to the reliance on business partners (especially trade partners) and their capacity to promote the adoption of new technologies. The more dependent a company is on its trading partners, the more easily it can be persuaded to embrace innovations. Innovations can also facilitate transactions and connections between business partners, which is why they tend to leverage innovation adoption in companies they cooperate with. Contrariwise, it is also possible that a company is ready to embrace a new technological solution, but their trading partner is not, which inhibits the process.
6. Regulators – legal barriers in the matter of absence of institutional structures and corporate regulations that regulate the use of technology. Also, we can include here government aid, as help provided by the authorities to stimulate the adoption of information technology breakthroughs in enterprises.
7. Innovation providers – this factor refers to the external assistance in adopting and utilizing the invention by the vendors. The third-party assistance, together with expanding outsourcing, have a significant influence on innovation adoption. Firms are

more likely to take the risk of experimenting with innovation when they have appropriate support.

8. Other factors – authors of the research named factors that could not uniformly fit inside the previously mentioned groupings. For example, social influence is one of such factors, meaning the public's, potential investors', and other stakeholders' perceptions of the desirability of a business implementing the technological innovation. Other factors that belong to this group are critical mass (frequency of using that influence perceived benefits), coercive pressure, cultural differences (cultural variations across nations) and normative pressure.

Nevertheless, the study of Puklavec, Oliveira and Popovič (2014) showed that the environment is not perceived as essential for influencing decisions of small and medium enterprises to embrace BA. Only one of the above-mentioned factors is included in the final list of relevant determinants, although lowest ranked, and that is the external assistance factor. The majority of determining factors are related to the organizational context, then the technological context and, finally, the smallest number of factors are related to the environmental context.

1.4 Case Studies on Readiness Assessment and BA Adoption Obstacles

Williams and Williams (2004) used their framework to assess BA readiness and adoption in two large organizations – a manufacturing company and a government agency. The first company believed that the BA solution could enable them to better manage revenues and profitability. They have included some future application users in the BA adoption process and provided adequate training. Although the BA application was eventually successful, numerous stumbling blocks might have been avoided with a thorough BA readiness assessment. First of all, they did not have continuous process improvement culture, so their employees struggled to acclimatize to the transition from static, monthly reports to new technology with daily updates. They did not have the culture of using information and analytical applications that would support the adoption of BA solutions. Also, the decision-making culture was entirely ad hoc, making systematic usage of the new analytical tool inside core sales processes difficult. The business/IT collaboration was also not so good. Many of these obstacles might have been avoided or better managed if the BA readiness assessment had been performed. A more comprehensive understanding of the decision-making and information and analytical applications usage culture would have enabled this organization to more proactively engage in process reengineering, and not only assume that the training sessions were sufficient.

On the other hand, the authors provided a case of a government agency that had been measuring BA readiness before the adoption and improved the likelihood that their BA investment will be profitable. The organization was pressured to be more efficient and increase service quality and has begun a BA program intending to provide timely, more

relevant information and suitable analytical tools so managers could increase productivity. Their position regarding BA readiness differs from the first company because they included best practices of incorporating business-centric techniques that specifically analyse and manage the business risk associated with BA expenditures. Firstly, the Agency undertook a thorough effort to guarantee strategic alignment between its plans, goals, and objectives, processes, and the BA tools needed to make those operations more efficient while increasing service. Furthermore, the Organization has a history of a continual process improvement culture. They have acknowledged the need to transform their culture in order to embrace the use of new analytical tools. The government agency was also assessing its technical readiness so it could improve its overall capabilities to obtain, cleanse, store, and deliver the data, if necessary. They promoted an effective business/IT partnership, including steering committees.

Regarding small and medium enterprises, the framework developed by Hidayanto, Kristianto and Shihab (2012) for assessing readiness level in SMEs mentioned in the previous chapter was used to determine the preparedness of Mode Fashion Group, a medium-sized company that has 14 retail stores and employs around 200 people. The results of their research have shown that the factors that were well defined are: effective business/IT partnership, cross-organizational collaboration culture, business-driven and iterative development approach, user-oriented change management, data quality and integrity, the importance of metadata, and the silver bullet syndrome. Factors that were fairly defined are: clear vision and established business case, strategic alignment, continuous process improvement culture and culture of using information and analytical applications. However, significant challenges can be discovered in business intelligence portfolio management and business-centric championship. The Mode Fashion Group showed a readiness score of 1.74 out of 3, which indicates that they are not yet prepared to use Business Intelligence. Mode Fashion Group should improve the following aspects in order to increase the chances of a successful BA implementation: the use of portfolio management, support from management (including championship), employees' skills regarding BA, data warehouse infrastructure and other technical readiness issues. The authors suggested that analysed firm should take action to improve their readiness in the aforementioned aspects, such as socialization about the BA systems, training for employees, outsourcing or hiring new members, creating portfolio management (especially for BA), implementing a business-driven, scalable, and flexible IT framework, and maintaining an adequate infrastructure for BA.

Gudfinnsson and Strand (2017) searched for obstacles that SMEs encounter while implementing BA. The information for this study was gathered through interviews, observations, and workshops across four small and medium manufacturing organizations. They also included employees in different business positions, such as CEO and managers. The results of this research have added to the existing literature on the problems of implementing BA in SMEs and gave advice to SMEs on how to avoid typical mistakes. The majority of these results have already been described in the literature, such as insufficient IT

support (or lack of alignment between IT and business strategy), managers' lack of interest, as well as lack of understanding of how BA could assist in decision making. Also, certain new challenges emerged, such as obtaining the necessary assistance when IT services were outsourced.

Below are listed all the difficulties that companies faced during BA adoption:

1. Managers and business owners have shown little interest in learning how to use BA as a decision support tool.
2. When IT is outsourced, businesses have difficulties obtaining the necessary assistance.
3. There is a lack of understanding about how BA analytics may help with production objectives.
4. Difficulties obtaining data that demand manual input.
5. Inadequate knowledge on how to apply BA analytics in general.
6. Not enough key performance indicators, with an emphasis on more company-specific KPIs.
7. Inability to see how BA may assist in improving the revenue.
8. In terms of ownership, family-owned businesses appeared to be less interested in adopting BA for assistance in decision making.
9. The manufacturing was not completely supported by the current IT support.
10. There is a risk of data overflow.
11. Having accurate data.
12. Relying on intuition.

All four businesses claimed to have data on nearly everything. Nevertheless, when the interviewers dug deeper into more particular elements of the working process, they began to see instances where data was entirely lacking. One company even stated that there were so many potential mistakes that they would be overwhelmed with data if they attempted to examine it all. One probable reason why the companies didn't make a detailed budget is that they practically sell anything they make. The company's executives didn't have enough knowledge on how BA can assist the objective of increasing output or help in business planning. In all these cases, businesses were far more concerned with lowering expenses than with increasing income and their attitude was that cutting expenses automatically increases profitability. This highlights the issue of a lack of awareness about how BA may help businesses identify new methods to enhance revenue growth and manage activities. The findings of Gudfinnsson and Strand (2017) laid the groundwork for understanding current practice and the problems that SMEs confront, as the research focuses on how technology is utilized and what problems organizations identify as impediments to increasing BA usage.

Scholz, Schieder, Kurze, Gluchowski and Böhringer (2010) analysed SMEs to determine their perceptions of BA advantages, difficulties, and business behaviour. The authors provided three general BA problem factors based on their findings:

1. This first problem is related to BA usage, and it involves claims that the systems and processes for creating BA reports are too complex. Employee's skills were also recognized as a difficulty, thus training is usually needed.
2. The second one included concerns such as software problems, poor assistance, insufficient security, conflicting data, and performance issues.
3. The third challenge included interface issues - restricted data export functionality and data conflation.

Olszak and Ziemba (2012) studied the factors that influence and hinder the implementation of BA in Polish SMEs. The primary business obstacles were a lack of well-defined business challenges that the BA should solve and a failure to define BA users' expectations. Furthermore, 9 out of 20 organizations cited a lack of alignment between the business and BA system as an obstacle. When it comes to organizational issues, the biggest obstacles were lack of management support and a lack of understanding of the BA system's potential. In 75 per cent of investigated organizations, the implementation budget was exceeded and BA project management was inefficient, which was identified as a problem, while BA projects were regarded as challenging in thirteen examples. Lack of training and assistance for users was also recognized as a barrier in the majority of firms, while user resistance was recognized as a barrier in 11 companies. Furthermore, several technological obstacles, such as a lack of adequate data and insufficient flexibility of the system, were found.

Raj, Wong and Beaumont (2016) analysed a company that was specialized in catering equipment solutions and wanted to make better use of their data. The firm had certain legacy IT difficulties that limited the creation of reports. The major difficulty was that they lacked significant experience in BA technology and the company's IT team was already occupied with the day-to-day support and retraining was not an option. BA solutions enable SMEs to analyse their present performance and compare it to the company's key performance indicators (KPIs). Thus, the authors emphasized it is crucial that before any implementation begins, the business's objectives and key performance indicators (KPIs) must be clearly established. While many SMEs see the benefits of using BA systems, the relatively complicated and costly implementation process frequently discourages them. Their research has shown that there are reasonably priced and quite intuitive BA solutions, and they can be integrated into SMEs' existing IT solutions without major problems. Before making the expenditure, SMEs should have a deeper understanding of their current systems. It is critical to have high-quality data in order to produce more accurate insights. This could be accomplished through the use of different transformation and cleansing phases. They concluded that the Microsoft BI tool package may be a good fit for SMEs looking to deploy BA solutions, especially if they currently use other Microsoft tools.

1.5 Summarization of the Previous Literature

In order to better understand the above-mentioned determinants from the literature review, I have summarized them and grouped by the authors into Table 1.

Table 1: Summarization of Readiness and Critical Success Factors by the Authors

Readiness Factors	Authors
Strategic alignment between IT and business	Williams & Williams (2004) Hidayanto, Kristianto & Shihab (2012)
Continuous process improvement culture	
Culture of using information and analytics	
BA portfolio management	
Decision process engineering culture	
Business and IT partnership	
Technical readiness	
Management support and sponsorship	
A strategic business vision and an established business case	
Cross-Organizational Cooperation	
Business-centric championship and well-balanced team structure	
Skilled Team Members Availability	
Business oriented and Iterative Development Methodology	
User-oriented change management	
Scalable and flexible technical framework	
Sustainable data quality and credibility	
Importance of Metadata	Boonsiritomachai, McGrath, & Burgess (2014)
BI and Data Warehouse Technical Readiness	
Innovativeness of the manager and understanding of BA benefits	
Perceived usefulness	
Adequate resources - organizational financial and technological	
Competitive pressure	Pedro, Brown, & Hart (2019)
Vendor selection	
Alignment to company strategy	
Powerful, dedicated Sponsorship (strong leadership and support)	
A data-driven decision-making culture	
Analytical skills (technological and business skills)	

(table continues)

*Table 2: Summarization of Readiness and Critical Success Factors by the Authors
(Continued)*

Readiness Factors	Authors
Good data infrastructure	Ariyachandra & Watson (2006)
The proper analytical tools	
Legal compliance for data protection	
Information quality (accuracy, completeness and consistency)	
System quality (flexibility, integration and scalability)	
Quick and simple access to data	
Data security	
Organizational impacts	
Support of change and innovations	
Knowledge	
Loyalty	
Resource allocation	
Continuous process improvement,	
Data warehouse and analytical skills,	
Using information and analysis applications,	
Measuring performance	
Knowledge-based decision making	Gibson & Arnott (2004)
Innovativeness of the manager or owner	
Manager knowledge and attitude towards BA	
Company's size	
Access to capital	
Influence of major customers	
Ability to implement BI	
Knowledge about BA and information systems.	
IS strategy	
IT skills	
Emphasis on operational systems	
Managerial obstacles	
Analytics centralization	
Competition intensity	
Government support	

*Table 2: Summarization of Readiness and Critical Success Factors by the Authors
(Continued)*

Readiness Factors	Authors
Data infrastructure	Lai, Sun & Ren (2018), Nam, Lee & Lee (2019), Chen, Chen and Bajwa (2016)
Data quality management	Nam, Lee & Lee (2019), Chen, Chen & Bajwa (2016)
Data availability, and the	Chen, Chen & Bajwa (2016)
Analytical capability	
Ease of use of BA	
Data driven organizational culture	
BA compatibility with organizational process	
Organizational maturity	
Anticipated benefits	
Strategic value of BA	
Anticipated costs	
Management support	
The existence of a project champion	
Organizational culture	
Adequate data environment,	
External assistance	

Source: Own work.

After listing all determinants from the reviewed research papers and case studies, I excluded the repeating factors, such as available resources, data-driven decision making, and IT/analytical skills. The majority of BA readiness factors originate from the frameworks developed by Williams and Williams (2004), who laid the ground for readiness assessment, and Hidayanto, Kristianto and Shihab (2012), who investigated readiness factors for SMEs. However, some factors that are relevant for the success of BA implementation are regarded as critical success factors rather than readiness factors. Since I decided to focus on the readiness factors in my master thesis, I will include only them in the final framework and exclude factors that are not directly correlated to the BA readiness assessment. Ariyachandra and Watson (2006), for example, focused on critical success factors instead of readiness factors, hence their research is not of main relevance to us. Process improvements, increased ROI, greater communication and cooperation across the organization's divisions and accomplished business objectives are all examples of organizational impacts as a result of BA implementation (Ariyachandra & Watson, 2006).

Analytics centralization, which is characterized by Nam, Lee & Lee (2019) as significant for later stages of BA adoption as it highly contributes to the success of BA implementation,

does not represent a criterion that has to be fulfilled before the adoption of the solution. A company's size is also one of the critical success factors.

Regarding technological factors, I included data quality, data/ IT Infrastructure, necessary analytical skills that include both IT and business skills and ease of use. Quick and simple access to data is something that will be achieved over time by the BA system usage. I have excluded factors regarding the scalability and flexibility of BA systems since the focus is on a company that did not decide whether to adopt BA and which system to use.

Business-centric championship and well-balanced team structure can greatly contribute to the BA success but are not mandatory for the company's readiness. Managers in small companies have a crucial role in advocating business intelligence. Furthermore, having employees with good analytical skills or the possibility to hire external IT and business experts is more important than having a balanced team structure in small enterprises. The Silver Bullet Syndrome, which represents the fact that more tools increase complexity in an organization, so BA teams should seek a minimal number of tools is also a critical success factor measured after BA adoption, so it will be excluded from the analysis.

Regarding environmental factors, Puklavec, Oliveira & Popovič (2014) marked government support as irrelevant for small and medium enterprises. They included only one environmental factor in their framework, although lowest ranked, and that is the external assistance factor. Small companies are less influenced by vendors' support and more by the outsourcing possibilities, although I incorporated the first component in the framework as well. Competition intensity that represents the degree of rivalry among companies and influence of major customers (smaller organizations are more sensitive to external pressures, such as customer demand) are also critical success factors. Since I am focusing on readiness factors instead of CSFs, I decided to exclude them as well.

Taking into consideration everything above mentioned, I created a readiness assessment framework presented in the following table (Table 2):

Table 3: BA Readiness Assessment Framework

Dimension	Readiness factors	Short description
Organizational	Manager's innovativeness and support	The most important factor since BA adoption depends on manager's opinion, innovativeness, knowledge and attitude towards BA.
	Clearly defined vision and an established business case	The business case has to be coordinated with the long-term, strategic vision.

(table continues)

Table 4: BA Readiness Assessment Framework (Continued)

Dimension	Readiness factors	Short description
	Strategic alignment	Business strategies and goals, key processes and BA applications should be strategically aligned.
	Defined business objectives and key performance indicators (KPIs)	Business objectives and KPIs need to be established before BA adoption.
	Perceived usefulness of BA systems	How decision-makers and employees see role of BA in achieving better performance. For example: Cost reduction, market growth, capturing new business possibilities, and strengthening connections with customers and business partners.
	Continuous process improvement culture	Performing necessary changes to fully utilise innovations.
	Culture of using information and analytics	The preparedness of a company to employ analytical tools to enhance the performance.
	Decision process engineering culture	Applying structured decision-making for better results.
	Cross-Organizational Cooperation	All the departments should work together since BA demands sharing knowledge at all levels. A company must foster a collaborative culture throughout the organization, in which everyone understands and contributes to the strategic objective.
	Functional use of BA	Enterprises which have conducted a thorough analysis of the main BA possibilities in multiple areas and are ready to manage BA as a portfolio and thereby optimize ROI.
	Business and IT partnership	Successfully leveraged IT in order to enhance the business performance.
	Access to capital/resources	Scarcity of resources can result in lack of technological knowledge in small enterprises.
BA compatibility with organizational process	The extent to which innovations are seen as being compatible with	

Table 4: BA Readiness Assessment Framework (Continued)

Dimension	Readiness factors	Short description
		current procedures for carrying out their goals.
	User-oriented change management	Possibility to enhance user engagement in the change process.
Technological	Data quality and management	Prevention of data mistakes; Credibility, accuracy, completeness and consistency of data
	Data/ IT Infrastructure	Data collecting, storage and processing.
	Analytical skills (IT and business skills)	Companies should particularly pay attention to their workers and their skills. Small companies can struggle with hiring experts with appropriate skills for BA implementation
	Ease of use	Directly influence adoption of BA (reduces costs, increases willingness to accept new technology).
Environmental	External assistance	Outsourcing; assistance in adopting and utilizing BA by the vendors;

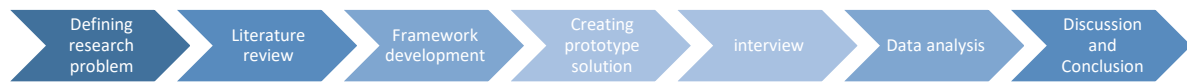
Source: Own work.

2 RESEARCH METHODOLOGY

2.1 Phases of the research process

This research methodology's initial phase involved a thorough analysis of relevant studies and the development of a BA readiness framework that could be applied to assess companies' readiness. In order to give company employees a better understanding of BA as a viable tool, it was necessary to design a prototype solution since perceived usefulness and ease of use are significant readiness factors. I used a sample of the company's data, which also assisted me in better understanding of their problems with data quality. The last step involved performing an interview with the employees based on previously developed readiness framework. For easier understanding of the research process, I illustrated it in the flowchart below (Figure 6).

Figure 6: Research proces flowchart



Source: Own work.

2.2 Participating Company

The company I have chosen to analyse is a small retail company in Serbia that ships its products to about 40 retail stores. They defined their vision as: “To be the best retail chain in the region that will set up the standard and measure of quality service together with factory prices of products. To achieve professionalism in all segments of business - to be the first choice for customers when purchasing, a desirable employer for employees, to become and remain a socially responsible company.”

The analysed company provided me with a data sample that contained sales information for four months - January, February, March and April of 2021, grouped by retail stores. They also sent me an additional table with sales data sorted by product categories for the same period, from which I extracted product information. I used an analytical tool to examine a sample of the company's data and generate reports on overall sales performance, performance by location, sales patterns, and data visualizations. My goal was to demonstrate the system's capabilities to company representatives. I used Microsoft Power BI, which delivers helpful data analysis and rich visualisation to help business users make rational choices (Raj, Wong & Beaumont, 2016). Power BI Desktop allows creating useful models and reports, which is especially valuable for the retail industry, as dashboards and data visualizations may assist retailers in keeping track of the current situation of their multiple retail locations. The tool's user-friendliness is one of its main advantages. With basic training, any Excel user who knows how to use pivot tables and charts may become a prospective Power BI user and create necessary analyses without requiring much technical support. Power BI does not require too big investments in the skills of the employees can be easily implemented from the technical point of view.

2.3 Interview design

The next step, the interview involves evaluating the company's readiness for BA adoption using the BA readiness framework presented in the previous chapter, including questions about prototype solution for assessing ease of use and usefulness of the system. Semi-structured, face-to-face interviews were conducted during November 2021 with ten company employees with logistic coordinator and supply chain manager job roles. With the

participants' permission, all interviews were taped for further analysis and lasted approximately 4 hours. The interview was designed to enable a thorough investigation of the elements influencing BA adoption in SMEs, and was based on literature review.

At the beginning of the interview, I presented the main functions of the Power BI programme to the employees, including data visualisation, calculations and forecast. In this, unstructured phase of the interview, respondents were asked to express their opinion of the adoption of a such tool without being shown the list of potential determinants. Afterwards, interviewees were asked questions based on the readiness assessment framework derived from the literature. Each question included further sub-questions. I explained the basic terms and goals of my research to them, to make sure they understand the topic. The employees responded to all of my questions and added their own observations they found relevant for my research. Finally, respondents were asked to indicate their agreement with the factors presented in the BA readiness framework and whether they would change anything.

Table 5: Interview Questions

Readiness factors	Questions
Manager's innovativeness and support	Do you consider your managers' innovative? How open they are to introducing new technologies? How important do you find their knowledge and attitude about technology for the adoption of a new business solution?
Clearly defined vision and an established business case	Is there a clearly defined vision and strategic goal of the company? What is your company's vision? Do you conduct business in line with the vision?
Strategic alignment	Are business strategies and processes consistent and supportive of one another? Are business initiatives aimed at enhancing the essential business and management procedures that generate profits?
Defined business objectives and key performance indicators (KPIs)	Do you have defined business goals? Are KPIs clearly established in your company?
Perceived usefulness of BA systems	Do you think that such a tool (analytical solution) would be useful in your business? In what way?
Continuous process improvement culture	How open do you think your company is to innovation? How often are current processes analysed and changed?

(table continues)

Table 6: Interview Questions (Continued)

Readiness factors	Questions
Culture of using information and analytics	<p>Do you use information technology for better business?</p> <p>Do you use data reports?</p>
Decision process engineering culture	<p>What does the decision-making process in your company look like?</p> <p>Is there a decision-making process for more consistent problem scenarios you encounter?</p>
Cross-Organizational Cooperation	<p>Are there more departments in the company?</p> <p>Do they collaborate and share information?</p>
Functional use of BA	<p>Do you think that BA could be used in several spheres in your company? In which ones?</p>
Business and IT partnership	<p>Can you explain how you use information technology in order to improve business performance?</p> <p>Are the right IT organization, infrastructure, and strategies in place to support business initiatives?</p>
Access to capital/resources	<p>Does the company have sufficient access to financial resources?</p>
BA compatibility with organizational process	<p>Do you think that BA could fit into your work process and help achieve your goals?</p>
User-oriented change management	<p>Are IT users involved in the change process?</p> <p>Can you communicate your demands to system architects and developers?</p>
Data quality and management	<p>Do you have data management and data quality control?</p> <p>Is data accessible? Is it regularly updated?</p> <p>Does it reflect true state of information?</p> <p>Is data format clear and understandable?</p> <p>How accurate is the data? Did you notice any data errors?</p>
Data/ IT Infrastructure	<p>How do you collect, store and process data in your company?</p> <p>Are there any interferences?</p>

(table continues)

Table 6: Interview Questions (Continued)

Readiness factors	Questions
Analytical skills (IT and business skills)	Do you think your team has enough technical skills to use BA? Do you think your team has the business skills to use BA? How long it would take to acquire them?
Ease of use	How straightforward you find this software is to use? What do you find complicated? What features do you find user-friendly?
External assistance	Are you using (or planning to use) external IT services? Do you need the support of the manufacturer when using the software?

Source: Own work.

3 PROTOTYPE DEVELOPMENT WITH POWER BI

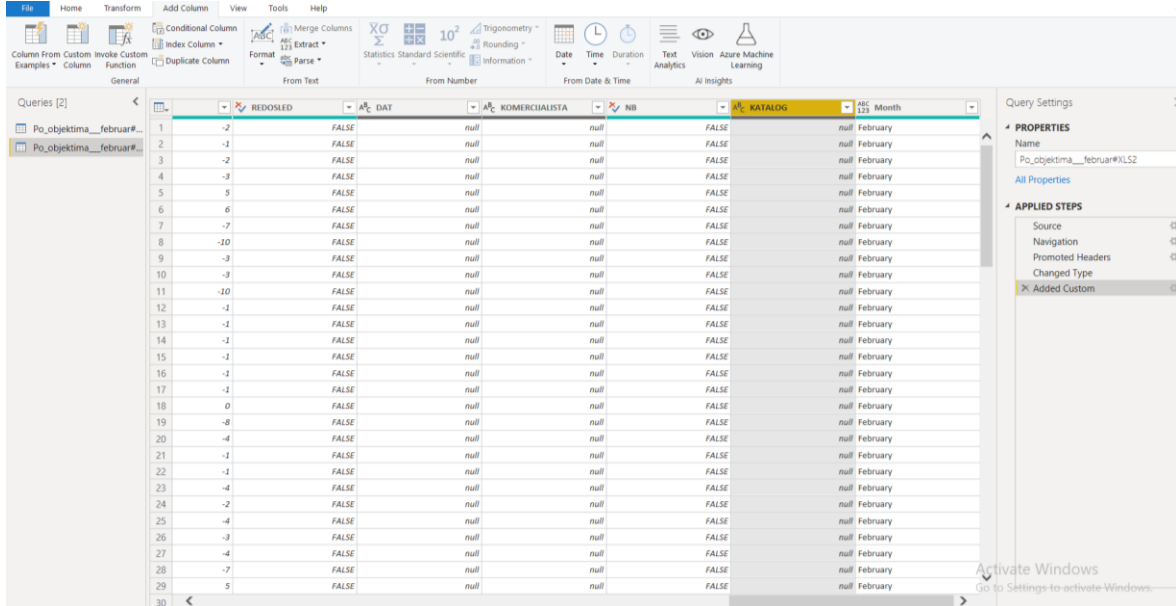
3.1 Data Preparation

After importing the datasets, some data preparations were necessary. Imported data can be transformed using Power Query Editor in Power BI. There are many options available, such as renaming columns, converting text to numbers, eliminating rows, setting the first row as headers and removing duplicates. It's essential to structure the data so that it matches the requirements and can be used in reports.

Initially, each table contained 20 columns. I used the query editor to add a column with the month name in each table, to rename columns, remove unnecessary columns and eliminate duplicates of data. For example, I removed the column “komercijalista” since it should contain the names of the people who are engaged in the business-to-business sales process. However, since my data included only business-to-customer transactions, in this case, it was empty. Similarly, column “redosled” represents product order and had the value “False” through the whole table and “Katalog” (product catalogue) was also empty, as the column with the same name is used for the wholesale. A similar thing was with the column “Vrednost rab”, which represents quantity discounts (an incentive given to customers when they purchase in large quantities) and was also empty since the company’s stores do not offer

such discounts. All these columns have been removed. An example of some missing values in the dataset and data transformation can be seen below, in Figure 7.

Figure 7: Missing values and data transformation



Source: Own work.

After removing unnecessary and empty columns and merging the tables with the Append function, I finally had 11 columns from the sales tables for January, February, March and April. I removed the duplicates and filtered out empty rows. I also changed the column names to make them easier to understand. Those columns and their meaning are described below, in Table 3:

Table 7: Metadata and New Column Names

Original column name	Meaning	New column name
SIFKUP	Store ID	StoreID
NAZKUP	Store name, named by the location	Store
SIFRA	Product ID	ProductID
NAZIV	Name of the product	ProductName
UL	Number of ordered and received product units for that month	QPurchased
IZ	Number of sold product units per month	QSold

(table continues)

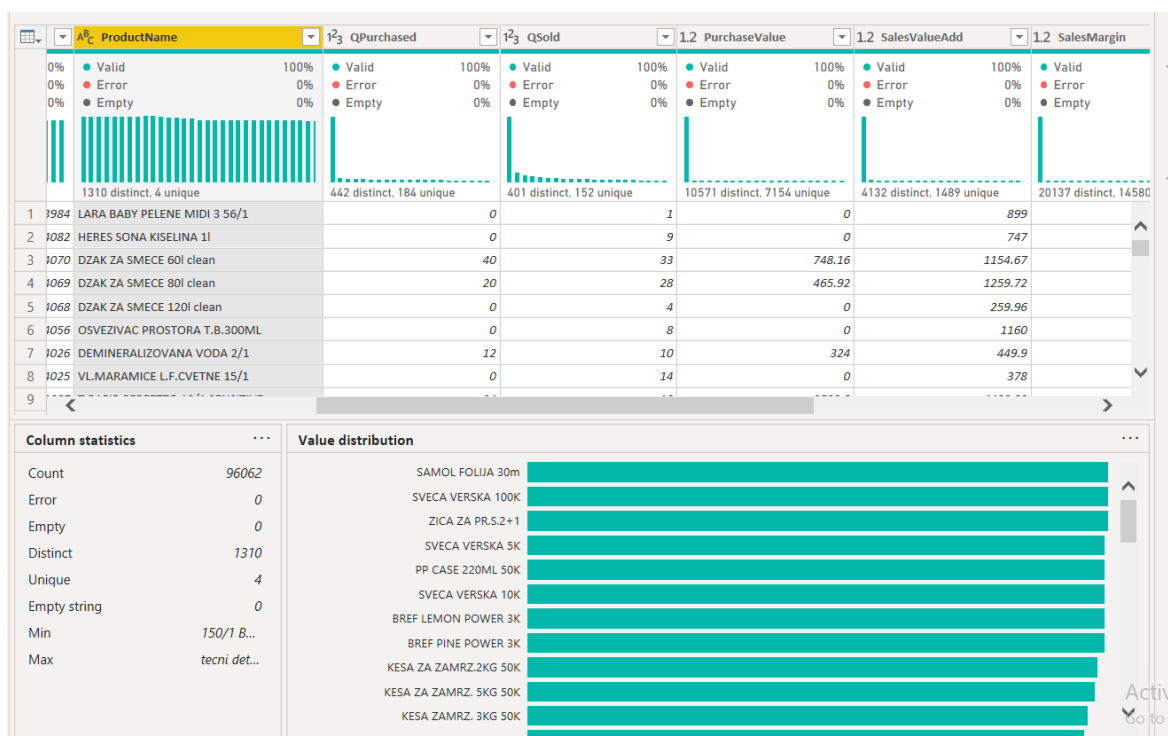
Table 8: Metadata and New Column Names (Continued)

Original column name	Meaning	New column name
NVRED	Purchase value	PurchaseValue
MARZA	Product margin per month	SalesMargin
NETOPVRED	Sales value of group of products per month	SalesValue
PVRED	Sales value of group of products per month with added customs and additional transportation costs	SalesValueAdd
SALKOL	The difference between purchased (distributed to stores) and sold products.	BalanceOfProducts

Source: Own work.

The sales margin represents the profit earned from the selling of a product or service. The SalesValueAdd represents the sales value with included additional costs of transportation and customs. Since almost none of the products in their offer have such expenses, SalesValue and SalesValueAdd are practically the same amounts. Finally, I checked again for data anomalies in Power Query, where I can see if there are any outliers in the dataset (Figure 8).

Figure 8: Checking for data anomalies and displaying data statistics



Source: Own work.

I changed the column profiling status to include the whole datasets instead of the first 1000 rows which is set by default. The Column Distribution feature detects data irregularities. The percentages of valid, in error, and empty data are displayed in column quality. In an ideal scenario, all of the data should be valid.

Column distribution displays the data distribution inside the column as well as the counts of distinct and unique values. Unique values reveal how many values appeared only once, whereas distinct values show the entire count of how many values are there (with duplicates and null values included). Column profile provides a more detailed look at the statistics of the data. This column contains a number of distinct values, including the number of rows imported, which is useful for determining whether your data was successfully imported. In this case, the Power Query showed all the data was valid and imported adequately, so I could move to the next stage of data analysis.

Since the Power BI does not recognize manually entered month names as data entries and cannot convert them to the date format, I created another table with listed months and their calendar order. I connected the table with the main table so that data in my visuals are chronologically presented.

Figure 9: Adding new column - MonthNumber

StoreID	Store	ProductID	ProductName	QPurchased	QSold	PurchaseValue	SalesValueAdd	SalesMargin	SalesValue	BalanceOPProducts	Month	MonthNumber
1017	17-BULEVA	4452	BREF COLOR AKTIV MORSKI 3	36	3	5605.56	749.97	157.85	749.97		February	2
1016	16-BUKOV	4452	BREF COLOR AKTIV MORSKI 3	9	3	1401.39	749.97	157.85	749.97		February	2
1016	16-BUKOV	3875	PALETTE R15 INTENZIVNA CRV	2	3	302.14	689.97	124.19	689.97		February	2
1013	13-NOVI B	4405	PERWOLL COLOR 1,8l	9	3	1378.28	899.97	291.32	899.97		February	2
1011	11-TEMER	4362	sky sunny CVETNI univerzalni	16	3	872.62	269.97	60.44	269.97		February	2
1010	10-BACKI J	4355	DUGA DVOSLOJNA SALVETA B	20	3	828.78	194.97	39.47	194.97		February	2
1009	09-KLISA 1	411	MAGIC PINE 750ML	18	3	900	237	47.5	237		February	2
1009	09-KLISA 1	508	PAPIR ZA PEC 5m	30	3	930	164.97	44.5	164.97		February	2
1008	08-VETERN	852	TIME ST. GREEN SP 0.65L	15	3	825	269.97	59.98	269.97		February	2
1008	08-VETERN	3952	VADEM.Z.P.ZA ODRASLE+CETI	-8	3	-684.48	419.97	93.29	419.97		February	2
1008	08-VETERN	3885	T.PAPIR PERFETTO 8/1 MEGA	16	3	2886.4	899.97	208.78	899.97		February	2
1007	07-SATELIT	708	SAMOL FOLIJA 30m	30	3	866.36	164.97	50.84	164.97		February	2
1007	07-SATELIT	55	AKTIV TEC EL. VIM 750ml	15	3	713.16	239.97	57.98	239.97		February	2
1006	06-NOVO	4404	PERWOLL BLACK 1,8l	9	3	1372.5	899.97	292.48	899.97		February	2
1005	05-FUTOG	3869	PALETTE INTENZIVNA CRNA 1	2	3	302.14	689.97	125.29	689.97		February	2
1004	04-KAC	4511	T.PAPIR 10/1 PERF.DELUXE NE	16	3	2167.16	749.97	218.18	749.97		February	2
1002	02-DETELI	3607	ASEPSOL PUMPICA H 1% 650ml	15	3	892.5	299.97	71.47	299.97		February	2
1002	02-DETELI	4135	PALMOLIVE SAPUN ALMOND	72	3	2302.56	164.97	41.54	164.97		February	2
1050	50-KARLOV	2526	LOVAC NA BOJE 16 SOFT	20	3	1986.6	447	74.51	447		March	3
1050	50-KARLOV	1858	SVECA VERSKA 10K	20	3	352.01	105	34.7	105		March	3
1050	50-KARLOV	4550	DOVE SAPUN CREAM OIL 100l	48	3	1939.2	209.97	53.78	209.97		March	3
1050	50-KARLOV	4032	SALVETE PERFETO 33*33 BELE	20	3	543.78	119.97	18.85	119.97		March	3
1048	48-ADICE	4253	sampon kamilica sky sunny 50l	1	3	31	164.97	44.48	164.97		March	3
1048	48-ADICE	4318	BIC I SENSITIVE HC 36	-33	3	-694.32	89.97	11.86	89.97		March	3
1048	48-ADICE	4117	NIVEA DEO PEARL BEAUTY 150	1	3	131.3	509.97	31.07	509.97		March	3
1048	48-ADICE	4642	UPALIAC KREMEN sekspir	100	3	750	45	15	45		March	3
1048	48-ADICE	3330	BREF BLUE ACTIV CHLORINE 3	27	3	4365.09	749.97	139.97	749.97		March	3
1048	48-ADICE	1064	KESA ZAMRZ. 3KG 50K	20	3	530.8	129	33.43	129		March	3

Source: Own work.

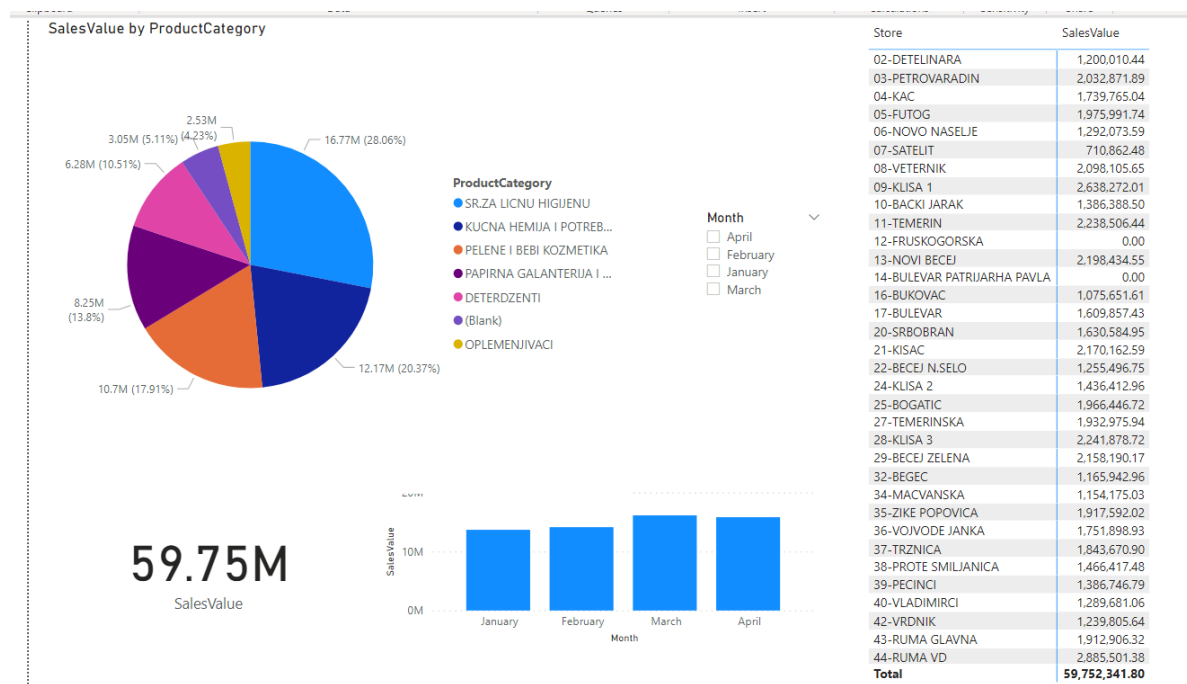
From the table that contained the information about sales data sorted by product categories, I extracted the columns that contained information about product ID and product categories and renamed them for easier handling.

In order to conduct the analysis, I had to manage the relations between the tables. I connected the table that contained information about product categories with the main (appended) table by the ProductID, using the one-to-many relationship. Similarly, I connected the table with the month names with the main table. Using the Related function, I also added another column to the main table, “MonthNumber,” which represents month's number in a calendar year based on the created table (Figure 9).

3.2 Data visualisation with Power BI

After data preparation, I was able to use the data and conduct the analysis. The analysis was based on suggestions from literature review, some suggestions from employees and possibilities of data itself. Firstly, I made a dashboard with key information regarding the sales values (Figure 10). It contained a pie chart that represents the sales value by product category, and I also included a slicer with month names so that sales value by product category can be presented for each month. I also added a stacked column chart that represents aggregated sales value by the months and a card with the sales value. Additionally, I added a matrix with sales values by the stores.

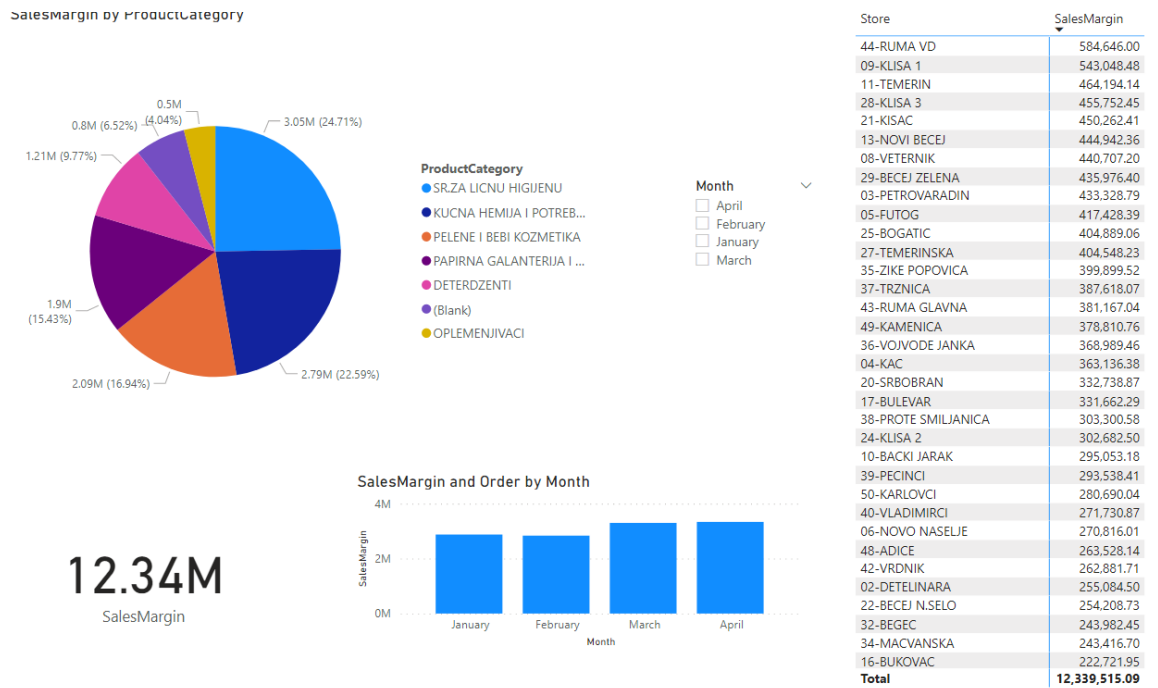
Figure 10: Sales value dashboard



Source: Own work.

Similarly, I created a dashboard that contained information about the sales margin (Figure 11). It included a pie chart that represents the sales margin by the product category, as well as the stacked column chart that represents sales margin by the months and a card with the total sales margin amount. Additionally, I added a matrix showing the sales margin in each store and added a slicer with the possibility to select a month.

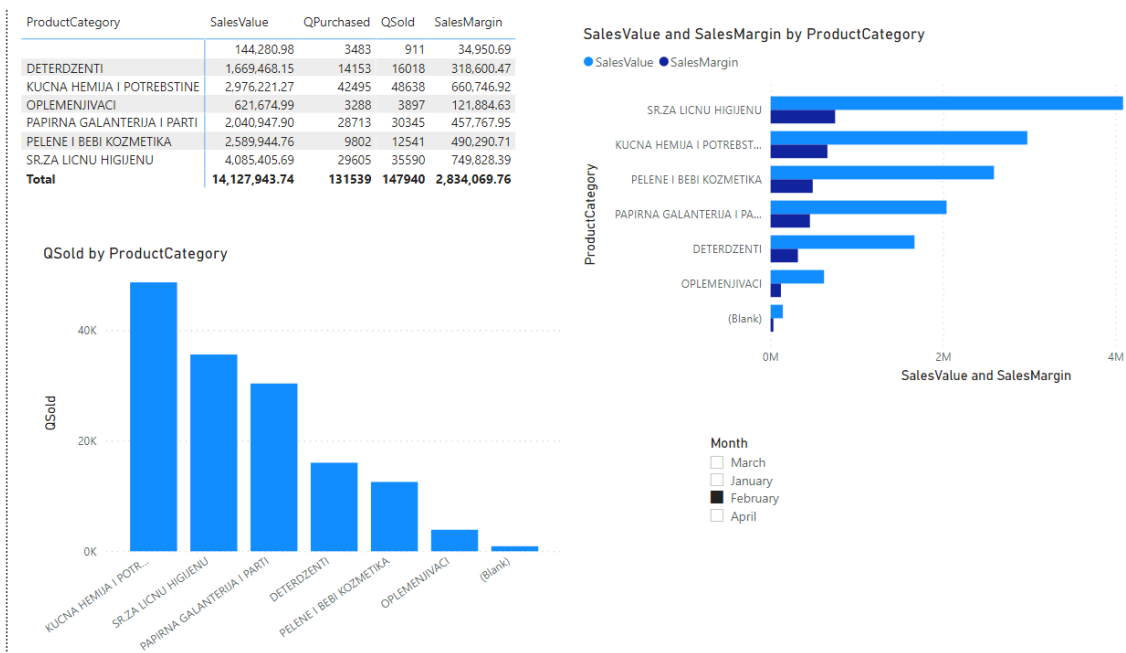
Figure 11: Sales margin dashboard



Source: Own work.

Then, I incorporated data visualizations that represented the quantity of sold products for each product category, as well as the sales value and sales margin for each product category (Figure 12). I added a slicer so that users can easily track sales performance per month.

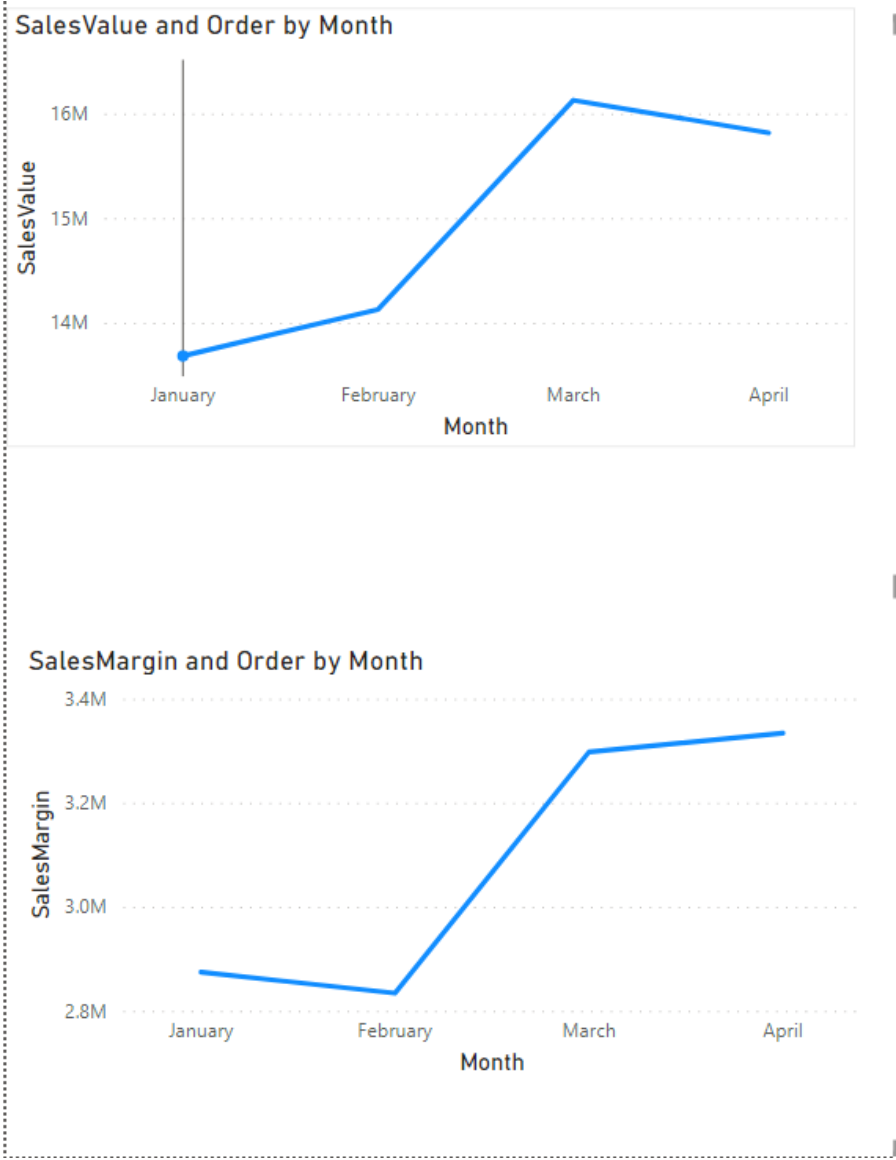
Figure 12: Visualisations by product categories



Source: Own work.

Line charts can also be useful for this type of data analysis. Power BI users can monitor trends (in this case sales value and sales margin) and even predict future tendencies. As we can see, sales margin does not have to have the same tendencies as the sales value (Figure 13).

Figure 13: Presenting sales value and sales margin trends



Source: Own work.

Subsequently, I made a few more visualisations to demonstrate the capabilities of BA tools. In Power BI it is possible to show sum, average, minimum, maximum, standard deviation, count, variance and median of values through various visualisations. For example, I added a matrix that shows sales value for each product category per month, that can be drilled down to individual stores (Figure 14), as well as the profit of each store per month shown as a percentage of total sales margin (Figure 15).

Figure 14: Presenting sales value by the months

ProductCategory	April	February	January	March	Total
OPLEMENJIVACI	663,235.07	621,674.99	567,781.41	675,047.79	2,527,739.26
prazno			0.00		0.00
VELEPRODAJA			0.00		0.00
07-SATELIT	7,254.45	8,043.50	3,919.72	4,679.65	23,897.32
42-VRDNIK	15,103.18	10,731.43	10,995.38	12,881.27	49,711.26
17-BULEVAR	12,987.15	13,489.49	9,929.43	14,869.18	51,275.25
10-BACKI JARAK	13,909.26	12,980.46	10,902.55	13,846.37	51,638.64
06-NOVO NASELJE	14,669.28	11,670.44	13,085.51	13,635.46	53,060.69
38-PROTE SMILJANICA	14,170.37	13,892.56	12,459.51	13,377.55	53,899.99
02-DETELINARA	13,486.49	14,179.44	10,697.51	16,017.34	54,380.78
48-ADICE	15,773.90	11,754.23	12,626.24	15,582.03	55,736.40
20-SRBOBRAN	14,957.31	11,529.53	14,445.61	15,847.46	56,779.91
34-MACVANSKA	16,962.86	14,877.03	11,204.26	14,756.99	57,801.14
16-BUKOVAC	17,461.11	14,763.55	11,272.59	14,596.37	58,093.62
24-KLISA 2	13,842.37	14,569.47	12,336.60	17,885.33	58,633.77
22-BECEJ N.SELO	15,000.41	11,383.60	17,165.49	15,591.56	59,141.06
13-NOVI BECEJ	14,320.43	16,819.53	14,136.51	14,736.45	60,012.92
49-KAMENICA	18,790.97	14,909.26	10,736.54	16,314.20	60,750.97
39-PECINCI	12,972.26	17,796.25	17,448.32	13,491.23	61,708.06
25-BOGATIC	16,640.00	17,102.95	13,055.20	16,590.99	63,389.14
32-BEGEC	17,418.20	17,238.39	12,415.49	18,691.38	65,763.46
36-VOJVODE JANKA	18,116.13	17,951.30	13,565.48	16,624.38	66,257.29
37-TRZNICA	17,029.07	16,454.12	12,599.33	20,795.08	66,877.60
08-VETERNIK	17,433.07	19,537.14	16,475.48	20,502.21	73,947.90
40-VLADIMIRCI	19,739.85	17,856.13	16,422.40	20,677.16	74,695.54
04-KAC	19,645.34	19,317.42	19,113.57	17,128.51	75,204.84
35-ZIKE POPOVICA	20,825.66	19,282.81	17,456.89	21,465.62	79,030.98
50-KARLOVCI	20,369.76	16,478.43	19,277.30	23,446.13	79,571.62
29-BECEJ ZELENA	24,734.12	17,027.50	18,859.56	20,114.16	80,735.34
27-TEMERINSKA	19,969.25	19,824.24	20,150.32	26,504.08	86,447.89
03-PETROVARADIN	26,675.76	18,459.10	18,492.20	24,594.91	88,221.97
43-RUMA GLAVNA	29,593.70	21,101.18	19,709.28	27,204.81	97,608.97
Total	15,815,030.60	14,127,943.74	13,681,680.68	16,127,686.78	59,752,341.80

Source: Own work.

Figure 15: Presenting sales margin in per cents

Store	DETERDZENTI	KUCNA HEMIJA I POTREBISTINE	OPLEMENJIVACI	PAPIRNA GALANTERIJA I PARTI	PELENE I BEBI KOZMETIKA	SR.ZA LICNU HIGIJENU	Total
02-DETELINARA	0.17%	0.26%	0.46%	0.09%	0.26%	0.32%	2.07%
03-PETROVARADIN	0.29%	0.35%	0.85%	0.14%	0.50%	0.49%	3.51%
04-KAC	0.20%	0.24%	0.56%	0.12%	0.41%	0.70%	2.94%
05-FUTOG	0.20%	0.33%	0.85%	0.17%	0.42%	0.50%	3.38%
06-NOVO NASELJE	0.23%	0.22%	0.53%	0.09%	0.30%	0.25%	2.19%
07-SATELIT	0.08%	0.19%	0.35%	0.04%	0.11%	0.16%	1.23%
08-VETERNIK	0.20%	0.37%	0.87%	0.12%	0.53%	0.49%	3.57%
09-KLISA 1	0.32%	0.39%	0.84%	0.18%	0.68%	0.95%	4.40%
10-BACKI JARAK	0.15%	0.20%	0.56%	0.08%	0.42%	0.35%	2.39%
11-TEMERIN	0.26%	0.37%	0.84%	0.17%	0.56%	0.76%	3.76%
12-FRUSKOGORSKA	0.00%		0.00%		0.00%	0.00%	0.00%
13-NOVI BECEJ	0.32%	0.18%	0.90%	0.09%	0.72%	0.52%	3.61%
14-BULEVAR PATRUARHA PAVLA	0.00%		0.00%		0.00%	0.00%	0.00%
16-BUKOVAC	0.09%	0.23%	0.43%	0.09%	0.27%	0.13%	1.80%
17-BULEVAR	0.14%	0.29%	0.65%	0.09%	0.36%	0.46%	2.69%
20-SRBOBRAN	0.13%	0.22%	0.70%	0.09%	0.36%	0.52%	2.70%
21-KISAC	0.16%	0.41%	0.80%	0.18%	0.62%	0.48%	3.65%
22-BECEJ N.SELO	0.08%	0.22%	0.43%	0.09%	0.25%	0.55%	2.06%
24-KLISA 2	0.16%	0.24%	0.54%	0.09%	0.48%	0.35%	2.45%
25-BOGATIC	0.15%	0.33%	0.77%	0.11%	0.54%	0.61%	3.28%
27-TEMERINSKA	0.29%	0.32%	0.71%	0.14%	0.65%	0.35%	3.28%
28-KLISA 3	0.25%	0.40%	0.85%	0.16%	0.44%	0.74%	3.69%
29-BECEJ ZELENA	0.14%	0.33%	0.74%	0.13%	0.52%	0.86%	3.53%
32-BEGEC	0.09%	0.18%	0.43%	0.10%	0.38%	0.27%	1.98%
34-MACVANSKA	0.11%	0.24%	0.45%	0.10%	0.30%	0.31%	1.97%
35-ZIKE POPOVICA	0.18%	0.37%	0.89%	0.13%	0.51%	0.42%	3.24%
36-VOJVODE JANKA	0.15%	0.25%	0.59%	0.10%	0.66%	0.59%	2.99%
37-TRZNICA	0.18%	0.31%	0.76%	0.11%	0.58%	0.49%	3.14%
38-PROTE SMILJANICA	0.23%	0.25%	0.50%	0.09%	0.39%	0.38%	2.46%
39-PECINCI	0.15%	0.15%	0.51%	0.10%	0.27%	0.54%	2.38%
40-VLADIMIRCI	0.08%	0.17%	0.45%	0.12%	0.44%	0.48%	2.20%
42-VRDNIK	0.32%	0.17%	0.45%	0.08%	0.31%	0.24%	2.13%
43-RUMA GLAVNA	0.22%	0.30%	0.67%	0.15%	0.42%	0.51%	3.09%
44-RUMA VD	0.28%	0.46%	0.96%	0.18%	0.65%	0.83%	4.74%
Total	6.52%	9.77%	22.59%	4.04%	15.43%	16.94%	24.71%

Source: Own work.

I assumed that presenting the names of products that were purchased in previous months but not sold would be useful to retail (Figure 16). This analysis would help users of BA tools in determining which products they can remove from their offer.

Figure 16: Presenting products that were not sold

ProductName	QPurchased	QSold
AIRFRESH AP.CIN300	1	0
BEBI SAMPON 800ML LARA SA PUMPICOM	3	0
BLIST DUO PINE LEMON	1	0
BODY L.MANGOMAND	2	0
BODY LOTION T.COCO	1	0
DET HAPPY BOSNA 3KG	1	0
FRESH SALVETA KARO	1	0
HAND SOAP HONEY 0.4L	26	0
KM PARFEM BOSS PURE210	4	0
KM PARFEM CHANEL108	14	0
KM PARFEM HYPNOTIZE105	8	0
MAL DEO SILVER 150	11	0
MAL.SH.FOAM IRIS 1L	1	0
NEVENA Baby kupka 400ml- plava	6	0
NEVENA Baby sampon 200ml- plavi	6	0
NEW EKO MIDI 74K	5	0
OMEKS. L.S.DAY 1L	2	0
PARF.M.C.WATER 204	10	0
PARF.M.G.MAN 201	8	0
PARF.WOM.R.JEANS 113	6	0
PARFEM M BL.BOS202	20	0
PARFEM M BL.SENS207	7	0
PARFEM POISINA103	6	0
PARFEM POISON 101	4	0
PARFEM Z MILION100	6	0
PARFEM Z THE ONE102	9	0
PARFEM Z TREZOR 116	13	0
PARFEM Z ULTRAV117	2	0
SONA KIS. 1L KR	1	0
SUN.ZA POL OBUCE	1	0
TENTO UB. GIG. XXL	3	0
TIME LS AL.MILK0.5L	2	0
TIME SOAP GRAPE.75G	3	0
Total	195	0

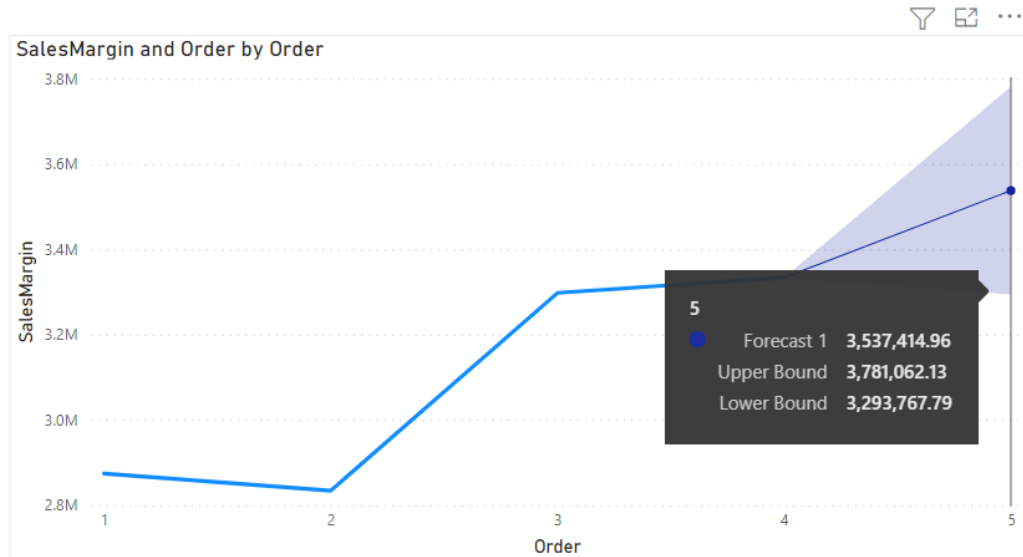
Source: Own work.

Finally, I added the forecast function to predict the sales margin for the following month (May 2021). The forecast also included upper and lower limits for expected sales margin, which can be used for decision making (Figure 17).

Similarly, I made a forecast of quantities sold, which can be useful for resource planning. I added slicers with store names and product categories, which can be also drilled down to product names so that decision-makers can predict more easily how many products to

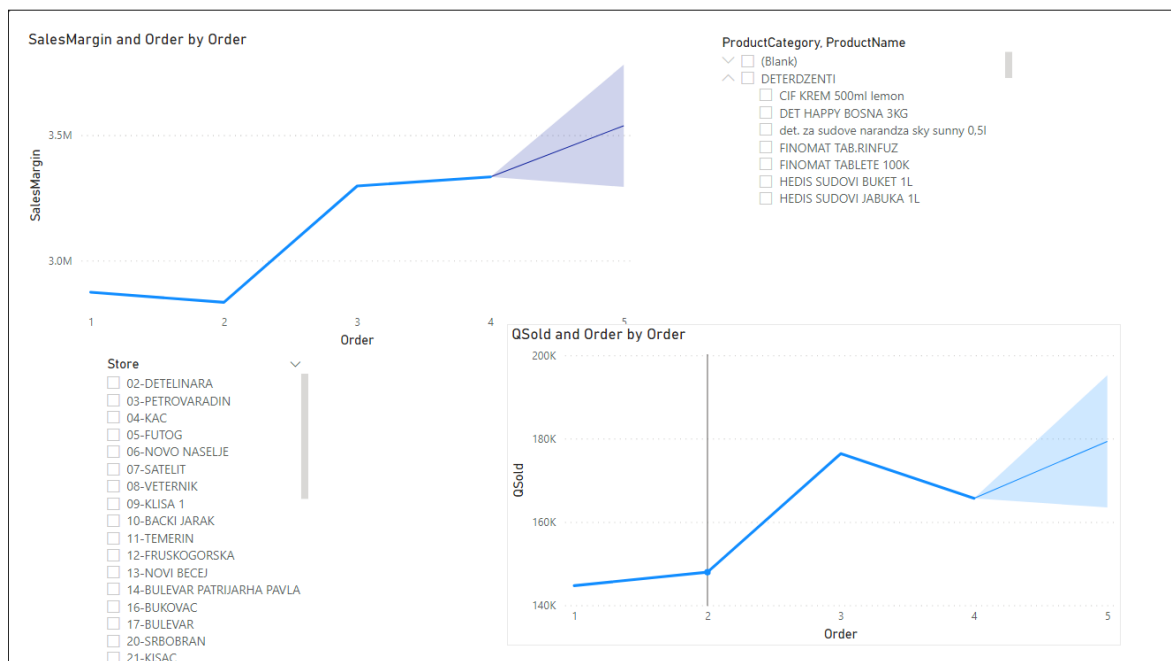
purchase in the following month and what sales margin to expect per product category and/or chosen store (Figure 18).

Figure 17: Forecasting sales margin



Source: Own work.

Figure 18: Forecasting sales margin and sales quantities with added slicers



Source: Own work.

During development of the prototype, I noticed some data quality issues such as missing information and inconsistencies. There were a lot of empty rows and columns, listed

products that are not in their offer anymore, as well as duplicates of data, making its interpretation quite confusing. There were also negative values among purchased quantities and consequently, the purchased value also had negative values. Balance of products as the difference between purchased and sold products also had negative numbers. This can happen when they sell more products than they bought that month, if there were already stocks from the previous month, but can be also result of manual data entry mistakes, when the seller accidentally enters the wrong code. Also, data did not always reflect true state of source information due to manual data entry, causing ambiguity and reliability issues. There was no data quality management or audit to control correctness of data. The company also neglected the importance of metadata, causing misleading information. Metadata is crucial because without the context, clean data is useless. All BA applications must carefully generate and manage the meaning of each set of data.

4 RESULTS

After demonstrating data analysis in Power BI and conducting the semi-structured interview, I summarized the results which I will present in this chapter.

Regarding the first determinant, manager's innovativeness and support, employees characterized their managers as moderately innovative. Company managers rarely experiment with new processes and services, only sometimes introduce new products. They emphasized that in the current situation with the COVID pandemic, innovation is not a primary concern for company managers. Investment in new tools would require a bigger expenditure without a guarantee it would pay off. Especially due to uncertainty, managers tend to invest in product range in retail stores which have more chance to increase revenue, rather than technical solutions. Employees added that there could be room for improvement in the future when the situation stabilizes. They also emphasized that in their opinion, a manager's innovativeness and technical knowledge have an essential role in the adoption of a new business solution.

Regarding clearly defined vision and an established business case, there is an established vision of the company, but not all employees are familiar with it. The ones that are familiar with the company's vision agree that the company operates accordingly – providing fair quality products for a lower price.

For strategic alignment, employees stated that business strategies and processes are consistent and complementary, and there is an alignment between strategy, goals, processes and tools. Business initiatives aim to enhance the essential business and management procedures that generate profits, even though there are not a lot of new initiatives. There is a constant effort to create marketing strategies that would lead to goal fulfilment. They also frequently compare their market position to competitors'. However, there are no objectives and key performance indicators (KPIs) defined. One of the main reasons is the lack of reporting. Company managers do plan to include it in the future. Currently, there is a lack of financial resources and even more important, people with adequate skills.

Interviewees said that introducing a BA tool such as Power BI into the workload would be useful for the organization, especially for managers. There were some changes in managers' workload which make room for new tasks, so it could be possible and useful for them to use such a system, especially in presenting the profitability of each store. There are some stores that make high revenues, but their fixed costs are disproportionately high making them less profitable. They could also predict which of the products generate the most profit and where to position them in stores. At the moment, managers rely on workers in retail stores who frequently provide their assessment, and alert them when some products are not selling well. The employees admitted they are not completely satisfied with their current system. Their biggest current issue is a slow system that frequently prevents them from extracting the data or does not allow other users from using it simultaneously. They are however unsure what kind of benefits they would receive, whether it would pay off, and whether it would require large investments.

As for the continuous process improvement culture, some employees believed the company is open to innovation, and some of them were not so convinced since they noticed some managerial obstacles. They all agreed processes are rarely changed, almost never. Only when the organization encounters a problem. The company observes how competitors run their businesses and try to improve their company's work in accordance with their mission and vision. Their priority is to provide products at the best possible prices. Subsequently, they pay more attention to the costs that directly lead to an increase in sales and reduce business costs as much as possible. The majority of team members are young and said they would be comfortable with introducing new processes and tools. They are aware that in order for the organization to incorporate the better use of data and analytical tools in their business, the corporate culture would need to change.

Regarding the culture of using information and analytics, the company employees currently use a simple, custom-made software solution to track sales in stores and provide some pre-defined reports, which they rarely use. Their system functions in a way that employees manually enter product data – quantities ordered and distributed, price and margin while sales data is extracted from cash registers in retail stores. Sellers in stores alert the company when they notice low stock or product shortages via the system that also collects data on sales and consequently, the company places orders for the products that are required and ships them to the stores. Manual data entry causes lower data quality due to duplicate, ambiguous and inaccurate data. Employees responded in the interview that they are trained to use their current tool which already has some reporting functions built in. Nevertheless, they do not use reporting on regular basis, especially due to data mistakes. They believe there is no sense in introducing analytics until the causes of lower data quality are solved, but they are open to such a possibility.

Next, for decision process engineering culture, employees explained that like in the majority of SMEs, they have a simple and highly centralized decision-making structure. Decisions are made solely by company owners who are also company managers and make day-to-day decisions as well as long-term investments. The managers mostly rely on intuition, with a

spontaneous and individualistic decision-making environment. Even though managers try to utilize the information for making decisions, they rarely use a quantitative approach. They have the possibility to utilize their system for decision-making but they rarely use it for reports. Rather they rely on sellers who would alert them if there is low stock.

Regarding cross-organizational cooperation, employees answered that since the company is small, information is easily shared among them. They all work together toward the fulfilment of company goals and address occurring issues together.

Concerning the functional use of BA, employees are convinced BA solutions can be used in multiple areas in their company, e.g., for easier purchasing, sales, decision-making, finances, and marketing. Still, the system would bring the most benefit to decision makers, while it would not significantly affect employees' daily work. Employees find it useful to review profitability and increase earnings, for example, to find out which stores are not profitable and should be closed etc., but it would not change the work processes of all other workers. At the moment, managers could extract the same data from the system, but with a lot of time invested. They believe Power BI would be a good fit for their work procedures, helping achieve company goals and bringing overall benefit to company performance.

As regards business and IT partnership, they use information technologies as an integral part of their processes to track stocks of products, and since their program is custom-made, they believe it could be changed to better suit their needs (for example for reporting purposes). The employees took part in the current program's design and emphasized they are willing to handle the adjustments needed to maximize BA investments. They use analytics to create reports, but not regularly, which they would like to include in the future. Given the turbulent changes in the market, company owners are not currently open to major investments in new tools. Their decision depends on how much the program costs, but they believe the company has sufficient access to financial resources.

In regard to data quality and management, although initially employees told me they did not have data mistakes in their system, I noticed some during data analysis, especially missing information and inconsistencies. There were many empty rows and columns, listed products that were no longer available and data duplicates, making interpretation difficult. Due to manual data entry, data did not always reflect the true state of source information, causing ambiguity and reliability issues. There was no data quality management or auditing to ensure data accuracy. Later during the interview, employees confirmed they notices data quality issues which, in their opinion, are mostly caused by manual data entry. Data are entered and processed manually on daily basis. Employees enter the data into the system based on ordered quantities from suppliers and merge it with sales records from cash registers in retail stores from the previous day. Internal price and sales calculations are done retroactively, which causes data mistakes. Also, retailers can enter the wrong product code while selling. Even though the data was accessible to the employees, they had issues when they tried to access it simultaneously due to slow system. The company also ignored the significance of metadata.

Regarding ease of use, employees find the BA prototype relatively simple and easy to understand. They liked the user-friendly interface and graphical reports, especially drag-and-drop functionality. They said they need user-friendly dashboards and data visualizations in order to understand complex data more easily and get the maximum value from BA. However, they said they would need help with data preparation and integration.

Employees believe they could easily acquire analytical (IT and business) skills necessary for using Microsoft Power BI and that a short training session with an IT expert who would introduce them to the new system and show them how to use it properly would be enough. They believe it would not take long, since the tool is quite similar to Microsoft Excel. However, they find lack of staff and insufficient time to dedicate to the adoption of a new system as significant issues. Their current workload does not leave them enough time to include new tasks. They do use external assistance in form of IT support, so it is a significant contributor to BA adoption.

Lastly, interviewees pointed out that outdated hardware might be an issue in some small companies. The company purchased new equipment in 2020, so they could fulfil system requirements for BA software. They believe purchasing up-to-date hardware represents bigger investments that not all small companies in Serbia can afford.

5 DISCUSSION

The results from the case study mainly support earlier findings from the literature review and provide some new insights. It was pointed out that SMEs are usually centralized, and owners and managers make the most critical decisions including whether to adopt new technologies. Thus, managers' innovation and support have been identified as absolutely vital for BA implementation. It is simpler to obtain the essential operating resources, such as financing, personnel, and other necessities, with the consistent backing and sponsorship of company leaders. Interviewees from my case study described their managers as being moderately innovative. They confirmed that managers' innovativeness is crucial for the adoption of the BA solution since they are the ones that make decisions. Employees also noted that company management does not prioritize innovation in times of uncertainty, which indicates that company managers are not keen on introducing a new technical solution to the company. Managers frequently invest in product lines in retail outlets rather than technical solutions since they perceive reduced costs as the best way to increase profitability. This is in line with the case study conducted by Gudfinnsson & Strand (2017), where they noted that all SMEs they observed were much more focused on reducing expenses rather than raising income, and they held the belief that doing so inevitably boosts profitability. This brings to light the problem of a lack of knowledge about how BA may assist companies in increasing revenue, considering investing in information technology as raising costs instead of an opportunity for higher efficiency and profitability.

A strategic business vision and an established business case are also significant for BA adoption. In order to serve the goals and demands of the organization, business cases must be aligned with the strategic vision. In this case, even though there is an established vision and business case, not all company employees are familiar with it, so they should be communicated better. Employees claimed that there is alignment between strategy, goals, processes, and tools and business initiatives aim to enhance the essential business and management procedures that generate profits, even though there is not a lot of new initiatives. However, there are no objectives or key performance indicators (KPIs) which should be clearly established prior to BA adoption.

Regarding decision-making, there is a variety of reoccurring decisions in management which can be enhanced by making the most of information and technologies to create structured decision-making procedures (Williams & Williams, 2004). The decision-making environment was mostly spontaneous and individualistic, making it more difficult to integrate the new BA tool into crucial sales and management activities. Managers had the freedom to utilize their system for decision-making and they rarely used it for reports. Even though managers try to utilize the information for making decisions, they rarely use a quantitative approach. Organizations that implement structured decision-making are better at making the most of BA systems compared to ones that do not.

BA requires knowledge exchange at all levels, all departments should collaborate when it comes to this topic. The more sharing of information is present at the company, the bigger the chance is to accept innovations and new products. Since the company does not have multiple departments, we cannot talk about cross-organizational cooperation between the units. However, due to the company's small size, information is easily exchanged among the staff members, which is equally significant.

Concerning business and IT partnership, companies that have effectively used IT to improve performance will be more prepared compared to those that do not encourage such collaboration, as explained by Williams and Williams (2004). Business and IT need to be closely integrated in order to effectively use BA to create value for the company. This organization uses information technology, particularly custom-made software solution as an integral part of their processes to track stocks of products, but they do notice room for improvement, especially for reporting purposes. Company employees occasionally use built-in analytics functionality and would like to use it on regular basis in the future. This is a good sign for BA adoption.

Interviewees did perceive Power BI as useful for their business, which is one of the most important factors for BA adoption. They provided examples of segments in which it would be especially beneficial, such as analysing stores' profitability and profitability of each product. It would also overcome their biggest issue with their current system, which is slow data processing and frequently preventing users from extracting the data or blocking multiple users from using at the same time.

As already mentioned by Williams and Williams (2004), businesses that have thoroughly examined the key BA opportunities across a variety of areas, including sales, marketing, manufacturing, etc., can manage BA projects as a portfolio of investments. BA projects that adopt a portfolio approach show a stronger dedication to modern technology and are better equipped to reap the advantages of BA. In my research, employees believed it can be used in multiple areas in their company – purchasing, sales, finances, and marketing. However, they cannot perceive its influence on daily work, but more as a tool for decision-makers. Thus, they could reconsider in which additional areas they could use BA.

Regarding BA compatibility with the organizational process, employees did find it could easily fit in their current processes, even though it would primarily benefit managers and directors, with little to no impact on the day-to-day activities of staff.

Businesses that have adopted a culture of continuous process improvement are more likely to make the necessary adjustments. Companies that are resistant to change are less likely to adopt emerging technologies like BA. Interviewees had different viewpoints on the culture of continuous process improvement. Some employees thought the business was open to innovation, but others were not so sure. They all agreed that processes are rarely adjusted, only when they run into difficulty. The corporation looks at how other companies operate in an effort to improve their own operations in line with their goal and vision. For successful BA adoption, business processes have to be changed accordingly and a culture of continuous process improvement would help them be more open to process improvements. Although the organization's culture did not promote continuous process improvement, its employees support the idea of using IT to enhance operational procedures and to see the commercial potential of BA.

Next, to utilize all the benefits, there should be a culture of using information and analytics prior to BA adoption. Businesses which accepted the use of information and analytical applications to improve their operations are more successful at making use of investments in BA. When asked about the culture of using information and analytics, employees indicated that they are trained to utilize their present technology, which comes with certain reporting functions. Despite this, they rarely use reporting, particularly because of low data quality. A lack of utilizing information and analytics can be a serious impediment to BA adoption. This is in accordance with case study by Williams and Williams (2004), where they observed that organizations that do not have large fixed costs are less pressured to include analytical tools.

Data quality is essential for the successful implementation of BA. Due to a number of problems, including poor system design and incorrect data entry, poor data quality is a major barrier to the effective deployment of BA (Strong, Lee, & Wang, 1997). Although employees initially claimed there were no data errors in their system, they later acknowledged that they had noticed errors and poor data quality, with data being manually input and processed as the main cause. Prototype development also showed issues with the correctness,

completeness and consistency of data, especially in sales margin calculation. There were not any efforts in data quality management. Since data users can misinterpret the meaning of terminology and concepts of data, using data may pose risks as the number of data sources increases. As a result, data producers must provide metadata describing various aspects of the datasets in order to reduce issues caused by misinterpretation or inconsistency. Poor decision-making, increased operational costs and decreased customer satisfaction can all result from insufficient data quality.

Solid IT infrastructure is one of the most crucial aspects for BA adoption, as it provides a technological foundation for the successful introduction of BA. It represents an indicator of whether the company has used data-related IT infrastructures for data collection, storage, and processing. As mentioned above, there are issues with data collection, which directly influence data quality. The company does not have adequate IT infrastructure and cannot adopt a BA solution until they address these issues.

Resource poverty has significant effects on small enterprises' capacity to adopt new technologies. Compared to large businesses, SMEs typically lack the resources. Due to a lack of resources, small businesses may struggle to find specialists with the necessary expertise for BA adoption. Employees in this case believe that the organization has adequate access to financial resources. However, they are not currently willing to make substantial expenditures on new instruments due to the current instability in the market.

Technical and business skills are needed to deliver the information and analytical tools that are part of BA, which are crucial for achieving its benefits. Employees find Power BI to be user-friendly, which is one of the important prerequisites for BA adoption. They believe that because Microsoft Power BI is quite similar to Microsoft Excel, they could quickly gain the analytical skills required for using it with just a brief training session with an IT professional. However, they consider the shortage of staff and the lack of time available to devote to the adoption of a new system to be more significant obstacles. Finally, when businesses receive the right support in form of external assistance or outsourcing, they are more willing to take the risk of experimenting with innovation. The company from my case study uses external assistance (IT support), which can significantly contribute to BA adoption.

The results of my research are mostly in accordance with the literature review. The difficulties that the company faces regarding BA adoption that were also recognized in research conducted by Gudfinnsson and Strand (2017) are: managers' lack of interest to understand how to include BA in decision-making and focus on lowering expenses, relying on intuition, data quality issues, key performance indicators not defined. Also, their interviews initially claimed they have all the necessary data, which was later proven wrong. On the other hand, the company I analysed differed from their case in the aspect of IT support (they were satisfied with it) and employees had a general idea of how BA can help them grow their revenue.

Similar to research conducted by Hidayanto, Kristianto and Shihab (2012), this company shares difficulties in areas of management support, creating BA portfolio management and data quality and infrastructure. It was also mentioned that Mode Fashion Group should invest in employees' analytical skills, outsourcing or hiring new people. In this case, employees are confident they would easily acquire new skills, but they suggest hiring new people due to the heavy workload.

In research conducted by Olszak and Ziembra (2012), the biggest obstacles were lack of management support and adequate data, which was also shown in my research. The biggest difference between our studies is that the employees that I interviewed had clear expectations of the BA system and were aware of business challenges that BA can address. This could be caused by Power BI demonstration prior to the interview.

Table 9: Summarization of the Main Findings

Readiness factors	Main findings
Manager's innovativeness and support	Innovation is not a primary concern for company managers. Especially due to uncertainty, managers tend to cut the costs rather than invest in technical solutions, which can represent a significant impediment to BA adoption. Managers should be familiarized with the possibilities of BA for their business, which can be achieved through a detailed comparison of pros and cons with projected ROI.
Clearly defined vision and an established business case	The company vision was defined, and the business case was established, which is positive. Nevertheless, it could be better communicated.
Strategic alignment	Business strategies and processes are consistent and complementary. Business initiatives aim to enhance the essential business and management procedures that generate profits, even though there are not many new initiatives. Overall, they are in a good position regarding strategic alignment.
Defined business objectives and KPIs	There are no KPIs established for now. They should be defined prior to BA adoption
Perceived usefulness of BA systems	Interviewees perceive Power BI as useful for their business, especially in analysing stores' profitability and the profitability of each product. It would also overcome their biggest issue with their current system, which is slow data processing and frequently preventing users from extracting the data or blocking multiple users from using it simultaneously. Usefulness is one of the most important factors for BA adoption.

(table continues)

Table 10: Summarization of the Main Findings (Continued)

Readiness factors	Main findings
Continuous process improvement culture	The organization's culture does not promote continuous process improvement, which can be a serious obstacle to BA adoption. Plans should be created to overcome this risk. However, its employees support the idea of using IT to enhance operational procedures and to see the commercial potential of BA which is a positive indicator.
Culture of using information and analytics	Despite having an opportunity and skills to use the current system for reporting purposes, they rarely do so, particularly due to low data quality. A lack of utilizing information and analytics can be a serious impediment to BA adoption
Decision process engineering culture	The decision-making environment was mostly spontaneous and individualistic, making it more difficult to integrate the new BA tool into crucial business activities. Using a more quantitative approach and BA reports for decision-making should be an assignment for managers.
Cross-Organizational Cooperation	To be successful in BA, a company must foster a culture of cross-organizational collaboration in which everyone understands company objectives and works to accomplish them. The cross-organizational collaboration is present in this enterprise.
Functional use of BA	BA can be used in multiple areas in the organization – purchasing, sales, finances, and marketing. However, they cannot perceive its influence on daily work, but more as a tool for decision-makers. Thus, they could reconsider in which additional areas they could use BA.
Business and IT partnership	Business and IT need to be closely integrated in order to effectively use BA. This organization uses information technology as an integral part of their processes, but they do notice room for improvement, especially for reporting purposes. They occasionally use built-in analytics functionality and would like to use it on regular basis in the future.
Access to capital/resources	They are not currently open to major investments in new tools, but they believe the company has sufficient access to financial resources.
BA compatibility with organizational process	Employees believe BA could easily fit in their current processes, even though it would primarily benefit managers and directors, with little to no impact on the day-to-day activities of staff.

(table continues)

Table 11: Summarization of the Main Findings (Continued)

Readiness factors	Main findings
User-oriented change management	Users better understand their needs from software solution than a developer who has no experience with the software. In this case, users are involved in the change process and can communicate their requirements which is a positive indicator.
Data quality and data management	Data quality is essential for the successful implementation of BA. The organization has issues with data quality, predominantly due to manual data entry. Prototype development also showed issues with the correctness, completeness and consistency of data, especially in sales margin calculation. There were not any efforts in data quality management. They could incorporate data dictionaries, corporate glossaries, business-focused dimensional modeling, working groups for data quality and corporate data models to achieve better quality data.
Data/ IT Infrastructure	There are issues with data collection, which directly influence data quality. The company does not have the adequate IT infrastructure and cannot adopt a BA solution until they address these issues.
Analytical skills (IT and business skills)	Interviewees believe they could quickly gain the analytical skills required for using it with just a brief training session with an IT professional. However, they would need additional support due to the heavy workload.
Ease of use	Employees find the BA relatively simple and easy to understand. They liked the user-friendly interface and graphical reports, especially the drag-and-drop functionality. However, they said would need help with data preparation and integration.
External assistance	The company already uses external assistance, which is a positive indicator.

Source: Own work

CONCLUSION

BA represents a significant contributor to organizational success. Through forecasting possibilities and data-driven decision-making, companies can reduce risks and increase their profitability. Although many SMEs see the advantages of implementing BA, the often complex and expensive installation process typically deters them. Due to limited access to capital, higher instability and smaller scope of business, small and medium enterprises are

more reluctant to adopt BA compared to bigger organizations. Therefore, conducting a readiness assessment to explore to which degree companies are willing and ready to adapt is crucial for successful BA adoption.

This research was conducted with the aim to analyze a company's readiness to adopt BA, and it includes both empirical and theoretical work. After summarizing relevant literature and developing the framework that was used to assess the level of readiness for BA adoption in small organizations. The framework, which includes nineteen factors obtained from relevant research papers - fourteen organizational, four technological, and one environmental, was then applied to assess BA readiness in a small retail company in Serbia. The readiness factors could operate as obstacles to the deployment of business-value-generating BA solutions. As a result, we need to understand the organization's situation in context of these variables and adopt a comprehensive perspective of where it is coming from. No company can score perfectly in every category, but some BA readiness areas can be improved more easily such as enhancing technical skills, which can be replaced with hiring technical consultants. Some other areas require more effort, for instance, changing company culture in order to use information and analytics. Prior to the interview with company employees, I prepared data analysis in Microsoft Power BI to demonstrate the possibilities of such a system to them and let them assess the user-friendliness of the tool, which is one of the determinants for BA adoption readiness. My assessment of the company using the proposed framework showed that they lack managers' innovativeness and support, defined key performance indicators, the culture of using information and analytics, data quality management and proper data/IT infrastructure. Data cleaning should be conducted, as the process of detecting and removing data errors and inconsistencies to improve its quality. It can be done through manual implementation or through writing of special application programs. Furthermore, they need to focus more on the continuous process improvement culture and explore how to utilize BA as a portfolio investment. Even though there are positive indicators in areas of business and IT partnership, analytical skills of employees, external IT support, knowledge exchange, perceived ease of use and usefulness of the system, there is still a lot of room for improvement. Altogether, we can conclude that the company is not yet ready to adopt BA.

It was confirmed that managers in small organizations play a critical role in promoting BA adoption. Managerial obstacles in form of a lack of managerial IT expertise, lack of innovativeness or resistance to the adoption of BA are significant barriers to BA adoption. Since top management should start the BA adoption process, managerial barriers can cause a significant delay. Moreover, the likelihood of BA adoption is much lower if top managers do not recognize the advantages of new technologies in their industry. Additionally, having access to external IT and business skills or having workers with strong analytical abilities is regarded as important. While process, culture, and management should all be taken into account while implementing BA, many firms just take technical factors into account. Organizational barriers that can cause resistance to change are more frequent than

technological ones. Based on this research, some of the biggest obstacles to BA adoption in small retail companies are lack of manager's support, defined KPIs, data quality, data/IT infrastructure, continuous process improvement culture and culture of using information and analytics. We should also take into consideration macro economical elements since a crisis can increase uncertainty and hesitation towards introducing new technology.

Making investments in modern information technology should be a key component of the company's strategy and help it achieve its goals. BA can be a significant asset for data-driven decision-making. However, a readiness assessment should be conducted prior to BA adoption, in order to resolve all potential obstacles.

The analysed organization should take steps to increase its readiness for the abovementioned factors. They should discuss BA capabilities with their managers, broaden their knowledge on the topic and create a more positive attitude towards BA. This should be the first step since the manager's support is critical for BA adoption. The next step is to work on data quality and suitable data infrastructure. High-quality data are essential for creating relevant reports, which can be achieved with data transformation and cleansing, and also by introducing data management. They should establish a process on how to avoid data mistakes in the future, and how to include BA in their processes. And finally, employee training, personnel outsourcing or hiring, and treating BA as portfolio management would be necessary.

Even though small companies usually have less capital available, there are affordable and user-friendly BA systems that can be easily integrated. Microsoft BI can be a good choice, particularly since they already utilize other Microsoft tools. My research showed that demonstrating the system's capabilities to the company's representatives is a good practice so they can assess the ease of use and usefulness of BA prior to readiness assessment.

The main limitation of this research is the size of its sample. It would contribute more to the research if I include more small and medium enterprises, in order to gain a better picture of BA readiness in companies in Serbia. It could also include organizations from other industries and create cross-industry parallels.

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APPENDIX

Appendix 1: Povzetek (Summary in Slovene language)

Opis problema - Podjetja, ki želijo v svoje delo vključiti poslovno analitiko (angl. Business Analytics, BA), se na tej poti srečujejo s številnimi težavami in ne dosegajo vedno pričakovanih rezultatov. Zato je ključnega pomena, da se skrbno lotijo uvajanja teh sistemov. Eden od glavnih korakov za zagotovitev, da se bodo prizadevanja na področju BA obrestovala, je izvedba ocene pripravljenosti. Število raziskovalnih člankov, ki se osredotočajo na analizo uvedbe in pripravljenosti BA v majhnih organizacijah, je omejeno, večina raziskav BA pa se nanaša na njihovo izvajanje v velikih organizacijah.

Namen tega magistrskega dela je bil razviti okvir za ocenjevanje pripravljenosti za uvedbo BA in prispevati k uspešnosti uvedbe BA v majhnih maloprodajnih podjetjih. Namen okvira pripravljenosti na BA je oceniti položaj organizacije in zagotoviti ustrezne informacije, ki jih je mogoče uporabiti za oblikovanje prilagojenih strategij in načrtov izvajanja BA, tako da bodo pobude BA zagotavljale čim večjo vrednost. Glavno raziskovalno vprašanje mojega magistrskega dela je: "Kdaj je podjetje pripravljeno sprejeti BA?".

Raziskovalna metodologija je sestavljena iz oblikovanja okvira za oceno pripravljenosti na podlagi pregleda literature, izvedbe analize podatkov in izvedbe polstrukturiranih intervjujev z zaposlenimi v podjetju. Uporabila sem program Power BI za analizo podatkov podjetja, izdelavo poročil o splošni uspešnosti prodaje, uspešnosti po lokacijah, vzorcih prodaje in vizualizacijah podatkov ter predstavitev zmogljivosti in enostavnosti uporabe sistema predstavnikom podjetja. Intervju je bil zasnovan tako, da je omogočil temeljito raziskavo elementov, ki vplivajo na uspešnost uvedbe BA v majhnih maloprodajnih podjetjih.

Predlagani okvir vključuje dejavnike iz treh razsežnosti: organizacijske, tehnološke in okoljske. Nekatere najpogostejše ovire za uvedbo BA v malih maloprodajnih podjetjih so pomanjkanje inovativnosti in podpore vodij, neopredeljeni KPI, kakovost podatkov in infrastruktura podatkov/IT. Poleg tega mala podjetja običajno nimajo razvite kulture nenehnega izboljševanja procesov ter kulture uporabe informacij in analitike, pogosto pa imajo tudi težave z zaposlovanjem ljudi z ustreznim znanjem IT. Vendar pa obstajajo cenovno dostopni in uporabniku prijazni sistemi BA, ki jih je mogoče relativno enostavno uvesti.

Prispevek tega dela je izboljšati znanje in omogočiti boljše razumevanje procesa uvajanja BA ter dejavnikov, ki vplivajo na uvajanje BA v majhnih in srednjih podjetjih. S tem pristopom naj bi podjetja lahko določila svoj trenutni položaj glede pripravljenosti na sprejetje BA in uporabila najboljše usmeritve, prilagojene njihovim posebnim potrebam, kar bi na koncu lahko povečalo sprejetje BA.

Glavna omejitev te raziskave je velikost njenega vzorca. Ugotovitve bi bilo mogoče v večji meri posplošiti, če bi vključil več majhnih in srednje velikih podjetij. S tem bi tudi dobil boljšo sliko o pripravljenosti na BA v maloprodajnih podjetjih v Srbiji. Prav tako bi lahko vključila organizacije iz drugih panog in ustvarila medpanožne primerjave.