



Business Intelligence Analysis in Small and Medium Enterprises

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ABSTRACT

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In order to share knowledge, through discussion and exchange of information, about the technological challenges and management in the digital age, this article discusses in the following sections:

First, the mining process - prerequisites and their application to "Small and Medium Enterprises" (SMEs) are discussed. Section two discusses "Using Customer Analytics for Success: The Case of Mexican SMEs."

In next Section reviews data management software solutions for business sustainability. Finally, a "marketing analysis" is provided by analysis of SMEs.

1. Introduction

Rapid technological advancements, which increase the ability to create and store data, as well as the growing interconnection of the real and digital worlds, encourage the adoption of new technologies (Accorsi et al., 2012). The mining process is a business process management trend that has finally made its way into the industrial world. Collaboration between process mining providers and corporate application suppliers such as SAP, Oracle, or Salesforce is the most powerful driver of process mining. Process mining tools in business process management can provide major benefits to large firms like Siemens and Vodafone (Kerremans, 2018). Reduced downtime, lower costs, and higher customer satisfaction are examples of how the mining process may help a company stay competitive or achieve a competitive advantage.

Small and medium-sized businesses (SMEs) are clearly lagging behind giant firms when it comes to digital transformation. Only a tiny percentage of SMEs are now poised to achieve their full potential, and the majority of SMEs begin with pilot initiatives (Müller, 2019; Müller et al., 2018). A crucial part of the digital industrial value chain, value chain digitization, is also articulated as an industry concept (Müller et al., 2018). The idea that large firms often employ professional business process management and work on the basis of clear and formal processes (Müller et al., 2018; Müller & Wigget, 2018) is another distinguishing trait between SMEs and large organizations. SMEs, on the other hand, are

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expected to be mostly implicit in their activities, and professional business process management is not often conducted.

Two important questions are explored based on these features of SMEs outlined in the existing literature: The first question concerns the mining process' prerequisites and when a company is ready to implement this technology. The second question is about how the mining process can be applied to SMEs. It must be determined whether the mining process is exclusively suitable for large companies, or whether equal benefits can be gained in small and medium-sized businesses with low levels of digitalization.

Finding the answers to these questions requires two processes. First: The prerequisites for a successful mining process are provided using a combination of quantitative and qualitative research approaches after the essential functions of the mining process are explained.

IoE technology has the potential to contribute significantly to long-term sustainability and development. Understanding the dimensions of this technology, its relationship to sustainable development, and how to apply it to build sustainable marketing can help improve processes and make marketing activities more efficient (Nozari, et al., 2021). Companies, on the other hand, must think of innovative ways to develop their business in order to get a competitive advantage. Business intelligence (BI), platforms, tools, and solutions are widely accepted.

It appears to be a good business approach that has become an important part of today's decision-making systems. When big data is turned into a competitive advantage, one of the benefits of BI is the chance to produce value for the firm. This has significant ramifications for executives who must choose which digital tactics are competitive now and in the future. We can create the future by considering solutions now; That is, where we are now and how we act (Samadi-Parviznejad, 2021). This technique appears to be unique to large firms in need of more storage technology due to a requirement to expand data storage capacity, but it might be a terrific opportunity for SMEs to flourish.

Even when SMEs have an edge in terms of flexibility and speed of response, there is typically a dearth of technical competence required to transform data into information to aid corporate decision-making. Furthermore, SMEs are hesitant to engage in any BI solution due to a lack of knowledge of the benefits of BI (Raj, Wong, & Beaumont, 2016). Because huge organizations have greater information technology assets, this condition has prevailed. SMEs must understand what their suppliers, customers, and stakeholders want in order to not just inform (or communicate with) one another, but also to make strategic decisions in the same way that major organizations do. SMEs must realize how important it is for them to connect with one another in order to respond to all of their stakeholders more quickly. The ability of SMEs to build processes that allow them to continuously acquire stocks and utilize data, information, and expertise is critical to their competitiveness. Companies can manage with complexities and changes in the current unpredictable environment using BI platforms and technologies. In Latin America, compared to rising nations with higher growth rates, there is a lower rate of investment in technological platforms (McKinsey Report, 2019).

Based on the owners' knowledge, a number of issues emerge, which can be described as a lack of strategic planning and professionalism in key business sectors. Poor planning and failure to fully outsource are among the obstacles of this organization (Saeid Nahaei & Naziri-Oskuei, 2021) In this perspective, business intelligence (BI) isn't a top concern, even if it can help with operational efficiency, process control, and client orientation. Because of the necessity to focus on the BI analytical component, the term business analytics was coined in the late 2000s. BI encompasses a wide range of approaches, procedures, structures, technologies, and solutions for gathering, analyzing, and accessing real-time data and turning it into actionable information that helps managers make better business decisions. On the other hand, today's digital world is challenging traditional marketing, and virtually no presence in

the digital space comes at the cost of a serious reduction in marketing outputs and the continued superiority of competitors. Obviously, in such an environment, digital marketing becomes a priority for companies and various manufacturing and service companies (Gharemani-Nahr, Nozari, 2021) BI&A is currently employed as an integrated concept. For BI&A, the term "big data" is crucial. Big data refers to large amounts of data that necessitate complex data management and analysis methods and technology (Iqbal et al., 2018). To make big data business decisions, BI&A employs statistical, processing, and analytical tools (Grover et al., 2018).

Volume (data amount), speed (data repetition), variability (data types), accuracy (clean data), and value are the five big data properties described by Chiang et al. (2018). The real value of big data for an organization, according to these writers, is generating value from data, and the success of BI projects requires understanding how to turn big data into a competitive advantage and strategic value for the company. This is, however, one of the most significant issues facing all organizations and researchers who use big data.

Big data is gathered by a variety of data collectors who record data using their own schemas, resulting in disparate representations of the same data. When attempting to acquire data by merging data from many sources, this heterogeneity is a significant barrier. Furthermore, any data source can generate and collect data without requiring centralized supervision, protecting huge data applications like Google and Facebook from assaults or failures. To provide uninterrupted service and quick reaction to local markets, many apps maintain a vast number of server farms around the world. However, the need for independent and decentralized resources is not solely to protect against assaults and technical faults. Different norms and regulations, seasonal advertising, bestsellers, and customer behavior in different nations / regions are all factors to consider. Finally, as the volume of big data grows, so does the complexity and interdependence of the sub-data. People develop amicable circles based on biological and social ties that usually exist not just in physical space but also in the virtual realm. These interpersonal interactions make it more difficult to present and argue big data plans that account for complicated data relationships and changing conditions in order to find useful patterns in massive data sets. As a result, using big data is a contemporary difficulty for businesses. Given the issues that limit SMEs' ability to supply macro solutions, the literature suggests qualities that SMEs should pursue while implementing macro solutions.

First, in a data-driven environment, SMEs constantly deploy SME solutions across the enterprise. Because they have the ability to implement and set up, the macro solution should allow firms to choose these solutions and use the solutions and systems they presently use without having to use them. Second, small and medium-sized businesses (SMEs) must follow this trend. The solution should be simple to adopt without the requirement for an IT specialist, and it should only take a few days or weeks of training for the organization to use it. Furthermore, dependable systems must integrate effortlessly to allow the deployment of new capabilities with current systems without the use of costly suppliers. Third, SMEs must hunt for the best price. Minor and medium-sized businesses must only respond to needs that require small start-ups and increase with increased analysis, and the answer must be fairly priced. This is particularly critical for firms that are fast expanding and must match software prices and capabilities to software growth rates and operational execution (Ogbuokiri, Udanor, & Agu, 2015).

2. Literature Review

Globally, information technology (ICT), particularly developing cloud innovations, is becoming an increasingly important aspect of business decision-making for long-term growth and competitiveness. Small and medium-sized businesses (SMEs) use cloud services to help them run their businesses more efficiently and gain a competitive advantage. The fundamental concern is how to maximize existing resources and chances for entrepreneurial success in a competitive environment with limited resources. Current advancements in ICT, particularly cloud-based business intelligence (BI), provide a plethora of opportunities for SMEs to drive their growth, sustainability, and competitiveness. However, most SMEs, particularly in developing countries, have yet to achieve the expected level of cloud BI acceptance and use. In particular, in developing nations, the usage of BI cloud services as an emerging technology paradigm is beset by obstacles such as sluggish acceptance and underutilization. This is primarily due to a lack of knowledge of the usefulness of business intelligence (BI) and the uncertainties that come with new developments. The five competitive forces model is offered as a strategy to encourage the best use of cloud computing for BI in an essay targeted at boosting understanding of how to use cloud BI. Gikandi and Njuguna begin by discussing the advantages of Cloud BI for small businesses. They concentrated their research on the roadblocks and uncertainties that must be overcome in order for SMEs to take advantage of the tremendous cloud BI prospects. New findings show how cloud computing may be used effectively for competitive business analytics. This could help to realize the benefits of cloud BI in terms of encouraging SMEs' long-term growth and competition (Gikandi & Njuguna, 2021).

The adoption of various technical advancements is becoming increasingly important to the success of small and medium-sized organizations (SMEs). Business intelligence (BIS) systems are one of the most important instruments for today's uncertain corporate operations. They have a substantial impact on business performance. Different internal and external risks, on the other hand, may have an impact on BIS acceptance. Using the Technology, Organization, and Environment Framework, Stjepi et al. investigated the hazards that affect BIS implementation in SMEs (TOE). To that purpose, they created a logistic regression model based on data acquired from a survey of 100 small and medium-sized Croatian businesses. The findings suggest that the TOE theoretical framework is being utilized to investigate BIS adoption in small and medium businesses. Small and medium-sized businesses should evaluate internal risks connected to the organizational dimension as well as external risks related to the environmental dimension, according to the findings. Their study did not uncover the influence of technological dangers, which include aspects of technological innovation that are thought to be related to the technology dimension (Stjepi, et al., 2021).

SMEs evaluated security procedures among small and medium-sized firms (SMEs) in small South African cities when using cloud business intelligence in a study conducted by Moyo and loock (Cloud BI). Their research proposed a five-part security paradigm for analyzing Cloud BI apps, which incorporates major elements of traditional security frameworks and approaches. This framework for IT professional communication and SME owner acceptance has been accepted. According to the findings, SMEs require user-friendly frameworks for evaluating Cloud BI products. The security assessment framework, which is regarded as one of the best standards and security frameworks accessible for use by Limpopo small town decision makers, is a crucial component of their research. Future study should include the demands of the end user when designing or providing new solutions for SMEs in small towns, according to their findings (Moyo and loock, 2021).

With the onset of the dangerous global Covid-19 epidemic in this age of the Industrial Revolution (IR 4.0), healthcare organizations are forced to use new technology to make their regular judgments. The Business Intelligence System (BIS) is one of the most talked-about breakthroughs, and analysts and industry officials are interested in it because of its ability to supply more intellectual information for

decision-making processes. According to the literature, BIS is used by companies in a variety of sectors, but most BIS programs aim to achieve predictable outcomes. Furthermore, BIS acceptability is poor among SMEs in general and in healthcare in particular. This is because of a number of things. As a result, the important factors of BIS acceptability in small and medium-sized healthcare firms must be identified and analyzed. Checked by Salisu et al., who used a systematic literature review (SLR) and an expert ranking review of 63 articles published in Scopus and WoS databases from 2011 to 2020 in a study of relevant criteria for BIS acceptance. 15 specialists were contacted after 22 determinants were discovered. SPSS software was used to evaluate the data collected from these experts. The research revealed that 15 determining factors were relevant, with one additional determining element added by the expert. As a result, a theoretical framework based on technology, organization, environment, and determinants as well as CEO theories was developed. The findings of this study add to the current BIS literature by providing a better understanding of key BIS decision-making factors (Salisu et al., 2021).³.
The Concept of Mining Process

In summary, process mining uses business process events to visualize the process (Yli-Pietilä and Kauppinen, 2016). The process can be defined as "the sequence of activities performed in a particular order to achieve a specific goal" (Monoz-Gamma, 2016). Process mining is a relatively new field of research that bridges the gap between process science and data science. , With the aim of discovering, monitoring and improving real-world processes using event reporting data (Vander Alst, 2016) Today, business processes are supported to varying degrees by information technology systems, and therefore the extraction process is possible because. It is a simple fact that data already exists (Rozinat and Gunther, 2014). An analysis can only be as good as the quality of its data. Process data must meet at least three conditions: each event must point to an item, an activity and a time stamp (Van der Aalst, 2011).

3. Process-related prerequisites

Awareness of the relevance and impact of business processes is a prerequisite for a successful mining process (Davenport & Spanyi, 2019.). A deep understanding of the inter-departmental and corporate processes among employees is the basis of this. It is recommended that processes be described and mapped in a coherent and ideal way using business process management software. Awareness of efficient process management will have a positive effect on customer satisfaction, compliance and quality of its products. It is essential that processes be implemented to a large extent with the support of information technology systems (enterprise resource planning - enterprise resource planning (ERP) systems, scheduling tools, or logistics software). Of course, this does not necessarily mean that 100% of the processes need to be fully digitalized.

4. Methodology

Prerequisites for Successful Process Mining Process extraction is a tool for professionalizing business process management and should be embedded in a suitable professional environment. If an organization wants to implement a mining process tool, it must be prepared accordingly. The basic requirements and prerequisites for a successful extraction process are explained by a case study. Initially, seven guided interviews were conducted with experts from three related fields: academic environment experts, business process experts from industry, and process mining tool providers. The result of these expert interviews is the basis of a quantitative survey conducted in the second step among companies in the German-speaking region. Seventy-nine valid responses were received from the quantitative survey, and as can be seen in the figure, both large corporations (66%) as well as SMEs (34%) responded.

The results are integrated into seven prerequisites that are recommended to be met before implementing the mining process tool. These prerequisites are general in nature and applicable to all types of enterprises.

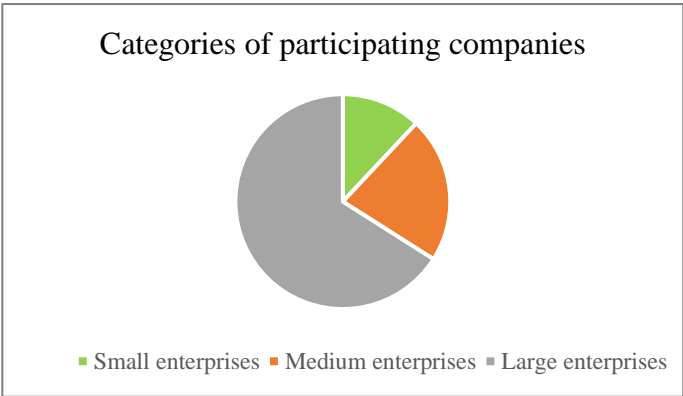


Fig. 1. Categories of participating companies

The proposed prerequisites for the mining process are general and it should be specified whether and how they are applicable to SMEs. Two case studies of SMEs in the German-Austrian border region have been conducted with the aim of answering the following two questions:

- Is the mining process a good technology for SMEs?
- Are the seven prerequisites for the relevant mining process met?

The most important steps in this model, like any other project with big data, are steps 0 called "design and justification" and step 1 called "extraction". Exploratory data analysis takes place in these early stages and understanding both business and data is crucial (Yu, 2017). At the beginning of a mining project, the process must be selected and the problems resolved. Understanding the IT landscape and all related functions is crucial. In-depth knowledge of available data and its quality must be established. According to two case studies, Case Study I: Production Planning, Case Study II: Delivery Process of Time, most efforts have been made in stage 0, including analysis if the seven prerequisites identified in the following processes are met for further analysis.

The process, as defined as domain, provides a deep understanding of business and data in detail. Therefore, processes are analyzed in three dimensions: process flow, systems / tools vision (analog and digital), and functions involved. Both companies use an ERP system that was the main source of data. Each of the seven prerequisites is thoroughly reviewed and rated on a scale from 0 points (prerequisite not met at all) to 10 points (prerequisite fully met). The test was proposed by researchers at Salzburg University of Applied Sciences and subsequently presented to and coordinated with representatives of the company. The result of this analysis was largely an equivalent result for both case studies. The result of case study one is shown in Figure 2. Although most of the prerequisites are generally met, it was found that the mining process at this stage only adds limited value to both processes.

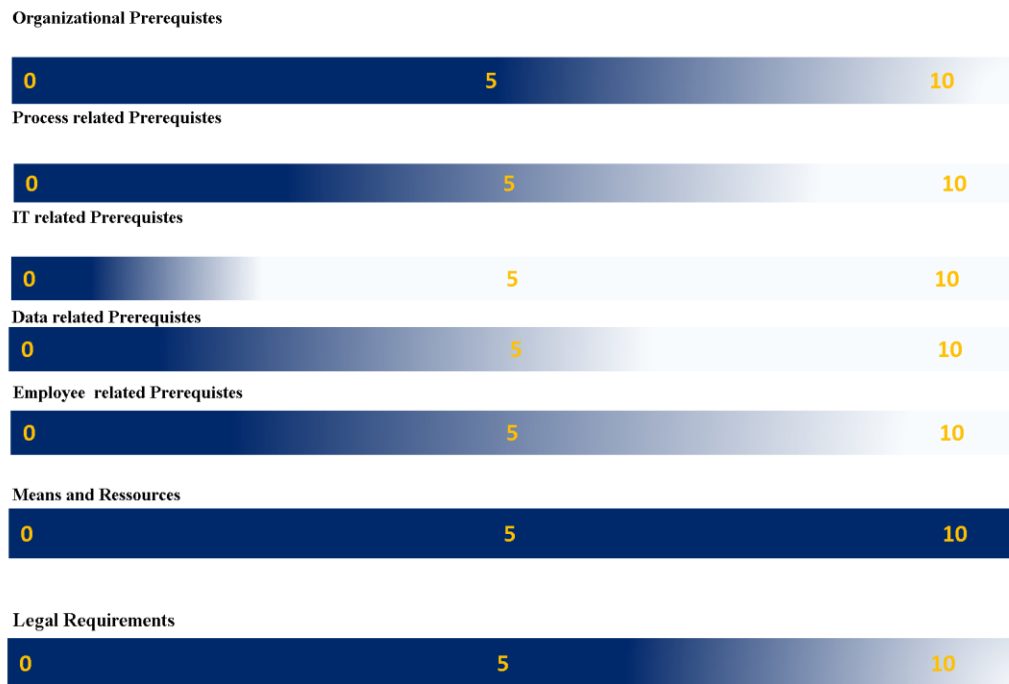


Fig. 2. Prerequisites Case Study I.

Although most of the prerequisites have been widely met, the mining process has been found to add only limited value to both processes at this point in time. Even if organizational prerequisites, employee-related prerequisites, tools, resources, and legal requirements are in good shape, the meaningful use of the mining process depends largely on the following three requirements:

- Process-related prerequisites
- Information technology related prerequisites
- Data related prerequisites

5. Analysis

These three requirements have been identified as key prerequisites for the successful implementation of the mining process in the case study period. Although there was a good understanding of the proposed process, it was found that the process is only partially supported by IT systems, although both small and medium-sized companies use an ERP system. This is because the full functionality of the ERP system is not currently being abused. Most activities are done manually and communication is done in a short way (by phone or in person). In case study I, 6 out of 18 activities in the standard process met the minimum requirements for reporting a significant event (case ID, activity, time stamp). In the end, it was decided to stop the process extraction project with each of the SMEs at this stage.

Knowledge can be generated by technologies such as data mining, machine learning, or predictive analytics that allow stakeholders to create domain models or identify patterns or rules. This high-level knowledge becomes an important element for decision makers to plan ahead and steer the organization toward more favorable internal and external conditions, as it allows stakeholders to answer the question, "Where will we be in the future?"

As we move from beginning to end in this information value chain, we discover technologies that increase the value of the business, but are also inherently more complex to implement and maintain.

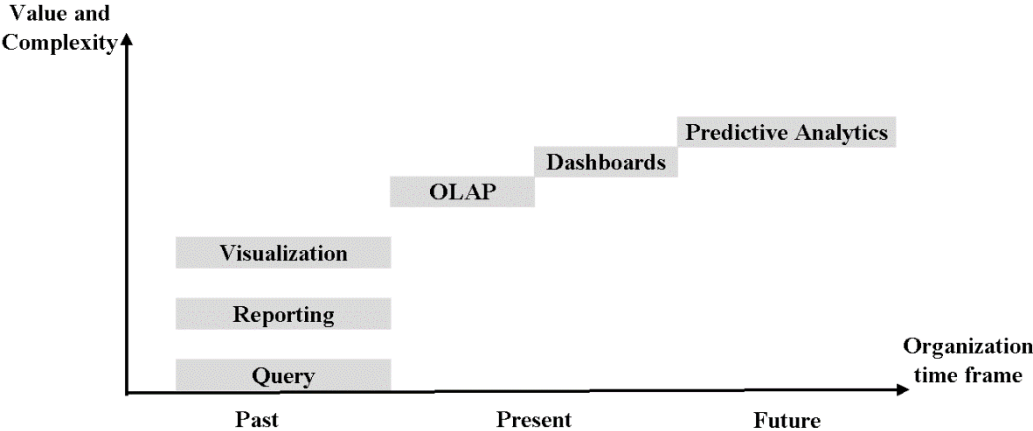


Fig. 3. BI technologies in relation to the organization timeframe and their value and complexity.

Factors include adequate human resource management, an appropriate governance framework, participatory work environments that support group-based decision making, and an overall focus on communication, problem solving, and risk and failure tolerance. Otherwise, implementing a BI initiative may only become a technical and financial burden for the organization. In addition, the BI solution cannot be implemented in the traditional way, as is the case with other systems.

BI is highly exploratory: it requires a discovery process that is done continuously, often when the solution is running. For this reason, classical methods such as waterfalls are no longer suitable because the path to the final goal is not always clear and therefore cannot be planned in advance. BI implementation not only requires a more dynamic approach, such as activating methods such as Agile, but also involves a much more diverse range of professionals, which may include programmers, database experts, data scientists, data engineers, statisticians, mathematicians. For these reasons, BI cannot be seen as a purely technological field despite the simplistic view adopted in Figure 3.

6. Conclusion

Rapid technological advancements and a growing acceptance of emerging technologies have created a new wave of opportunity to improve small and medium businesses in today's globe (McKinsey, 2019). Digital platforms, advanced analytics, and the Internet of Things may all help small firms develop and scale by enhancing productivity and expanding into new markets.

Big data is not just for big businesses; SMEs can use massive volumes of data to make faster, more accurate decisions that boost their bottom line. This article suggests that SMEs carefully consider embracing big data in order to improve their company processes and obtain a better understanding of their customers in order to develop customer engagement strategies. Social media, in particular, is a rich source of data and has the potential to become the next-generation business intelligence platform. Companies should also leverage social media as a rich source of information as well as a platform for business implementation, not only for product design and innovation, but also for customer involvement. In general, social media analytics are expected to aid in the improvement of marketing strategies, the creation of better customer interaction as a result of better services, the improvement of brand awareness,

the development and improvement of products, and the identification of new business opportunities (Kurniawati, Shanks, & Bekmamedova, 2013).

Furthermore, the data reveal that the relationship between small and medium-sized businesses and the difficulties of surviving in an increasingly competitive market underlines two key characteristics that can help them improve their competitiveness. To begin, SMEs must adopt digital strategies that will allow them to not only stay in the market, but also to develop and thrive in the long run. They must strive to differentiate themselves on a continual basis by developing competitive advantage through dynamic adaptive capacities and a strong focus on innovative methods. This can only be accomplished through a thorough strategic planning process that is both adaptable and dynamic. Second, public and private institutions must provide specialized consulting tools not only in important administrative management procedures and activities, but also in the digital, automation, and data analytics areas, which create value and help SMEs to stay in the market over time. These institutions must also recognize the unique resources and skills they provide in order to change, refresh, and successfully incorporate these resources and capabilities into commercial strategy.

Nonetheless, these two case studies yielded useful results. Clearly, neither company is ready to make a beneficial use of the mining process. It is suggested that they digitize their essential procedures. Black boxes have been found using the current life cycle model and process analysis, and this study gives useful feedback for continual development. Both corporations agreed that mining will produce useful information for their businesses in the near future..

In summary, the two main questions are answered as follows

- Is the mining process a good technology for SMEs?

The mining process can bring added value to an SME, but the SME must be prepared diligently. Thus, the usual limitations of SMEs in relation to digitalization, especially competencies related to information technology, financial resources, and lack of economies of scale, must be met (Müller 2019; Müller et al., 2018).

- Are the seven identified prerequisites for the mining process met in the relevant SME?

In both cases, most of the prerequisites have been met, but there were significant shortcomings in the core prerequisites: process prerequisites, information technology prerequisites, and data prerequisites.

From a managerial perspective, small and medium-sized enterprises as well as large corporations can benefit equally from the mining process, provided that key requirements are adequately met. Therefore, this paper provides the first insight into the prerequisites that must be met for the implementation of the mining process, and in addition, two case studies were reviewed as an empirical basis for a better understanding of the mining process in SMEs. Thus, scattered empirical evidence on the emergence of industry in small and medium-sized enterprises in a technology adds less attention (Müller 2019; Müller et al., 2018). For future research, the implementation of the mining process should be considered not only from the perspective of SMEs or large companies, but also in relation to their interaction during the implementation of the mining process throughout the supply chain.

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