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articles

Measuring the Success of Digital Transformation in German SMEs

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The pace of digital disruption in firms is omnipresent and has been accelerated by the emergence of COVID-19. Using digital technologies requires financial resources to create value. As these resources are limited in small and medium-sized enterprises (SMEs) and digital use cases and best practices are not well known, the purpose of this qualitative study is to investigate how SME managers are adding value and achieving a measurable return on investment (ROI) by using digital technologies. The study reviews a range of literature and models relating to digitisation impacts within SMEs. Further, it entails in-depth qualitative research on digital transformation in SMEs to explore the usage of digitisation and measurements of the added value and return. By inductively performing a multiple-case study of eight German SMEs, the researchers provide evidence to determine the usefulness of data analytics in SMEs. The study delivers a rich overview of added value, benefits and ways SMEs can use various ROI opportunities. Five benefits are revealed: increased revenue, improved customer satisfaction, improved employee satisfaction, efficiency and productivity. In addition, the case studies yield 25 significant positive ROIs in numerous use cases where data analytics solutions are implemented to improve revenue or cut costs. The weighted ROI average in this study is 13.44. Thus, most of the investments are highly worthwhile.

Introduction

The rapid proliferation of cutting-edge technologies is omnipresent and has created various new opportunities for small and large enterprises (Neumeyer & Liu, 2021). Innovative digital technologies reshape the global economic landscape and markedly influence organisations in all industries. Digitisation is a megatrend, further accelerated during the COVID-19 pandemic, jeopardising existing business models and promising extensive opportunities simultaneously (Bleicher & Stanley, 2016; Carayannis et al., 2006). Advances in, and the growing availability of, digital solutions force companies to rethink their business models due to their disruptive impact (Carayannis et al., 2006). This change has a profound effect on a company's performance and economic growth. For instance, the speed and ease of communications among economic actors can be enhanced through digital technologies (Carayannis et al., 2006; Iddris, 2018; Solberg et al., 2020; Tarutė & Gatautis, 2014). Thus, adopting new digital technologies can substantially contribute to efficiency and effectiveness and is a crucial source of a firm's short- and long-term competitive advantage (Neumeyer et al., 2021; Neumeyer & Liu, 2021).

SMEs have been recognised as a critical component of, and a dynamic driving force for, various economies. They are often responsible for most of the innovation, employment and growth in national economies (Bouwman et al., 2018; Carayannis et al., 2006; Celuch et al., 2014; Esselaar et al., 2007). In the European Union (EU), SMEs represent 99.8% of all companies and two-thirds of all employment (Carayannis et al., 2006). However, SMEs are not fully exploiting the potential of digital technologies and are lacking in technology adoption as they frequently overlook resources, such as personnel capacity, skills and funding (Bouwman et al., 2019; Carayannis et al., 2006; Li et al., 2018; Neumeyer et al., 2021). Esselaar et al. (2007) argue that the prime constraint to adopting digital innovations remains overly high investments and usage costs. In addition, many SMEs are often unaware of innovation potential of digitisation and struggle to assess the effects of digitisation to understand what they can digitise and the necessary technology that fits the purpose (Heberle et al., 2017).

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According to Barann et al. (2019) and Neumeyer and Liu (2021), SMEs need more orientation on how managers acquire digital literacy and technology adaptability. They must possess general knowledge of how they can effectively use technology and a better understanding of digitising business models (Bleicher & Stanley, 2016; Cenamor et al., 2019). Mainly due to their lack of financial resources, support, know-how and strategic mindset in terms of digitisation, an assessment of a possible digital ROI is relevant for SMEs to verify whether digital technology is increasing company performance or not. This could guide managers of SMEs towards digitisation and lead to higher acceptance of digital solutions and a general increase in digitally transformed SMEs in the economy. The adoption of technology is particularly essential for SMEs to compete with larger and less resource-constrained firms (Neumeyer et al., 2021). However, there has only been basic research on how SME entrepreneurs can successfully digitise their business (Pulka et al., 2018), and literature on the impacts of digitisation remains sparse (Neumeyer & Liu, 2021). Thus, the influence of digital technologies on traditional SMEs' business models is an area largely open for new avenues of research (Bouwman et al., 2019), and this study intends to fill this gap. Given this interest, the aims of this multiple-case study are (i) to investigate how SMEs are adding value and creating returns by using digital technologies, such as big data and analytics solutions; (ii) to identify the drivers and barriers of an SME's digitisation strategy; and (iii) to determine the ROI associated with SMEs' usage of data analytics solutions.

Literature Review

Digitisation, Digital Transformation and a Digital Strategy in SMEs

As Schumpeter (1942) stated in his work on 'creative destruction' and technological change, innovation is the key to value creation. Schumpeter defined this technological change as the main driving force behind sustainable economic growth, 'which incessantly revolutionises the economic structure from within, incessantly destroying the old one, incessantly creating a new one' (p. 8). This dynamic principle underlines the significance of the continual replacement, renewal and reinvention of socioeconomic, technological and political structures (Carayannis et al., 2006). In recent decades, innovations have tended to coincide with digital transformations. According to Neumeyer et al. (2021), digital technology and innovation are intrinsically intertwined, as many innovations are facilitated by technology or are digital technologies themselves. The use of new technologies and achievement of digital transformations have significantly affected broader development benefits, especially in entrepreneurship. This has largely been ignored in the literature (Galindo-Martín et al., 2019). An analysis of the literature reveals that *digitisation* is known as the implementation of digital technologies in business, economy and society, offering technical elements, such as hardware or software devices (Cenamor et al., 2019; Rosin et al., 2020) to improve or disrupt business models, processes and products and services (Denner et al., 2018). According to Cenamor et al. (2019), digitisation was initially a technical issue and has increasingly become a strategic management topic that affects value propositions.

Today, a clear and coherent *digital strategy* drives digital transformation and maturity to a great extent. The digital reshaping of the SME and the introduction or leveraging of new technologies in prioritised ways are primarily determined by a clear digital strategy (Kane et al., 2015). Therefore, SME managers should anchor digital technologies as a strategic pillar to provide a sustainable competitive advantage (Neumeyer & Liu, 2021). According to Solberg et al. (2020), having a digital mindset is essential when formulating a digital strategy. However, the tremendous power of a digital strategy lies in its scope and objectives (Carr, 2003). SME owners enormously benefit from greater transparency and knowledge of their company's managerial processes, objectives and the value they can derive from incorporating a digital strategy. Digital transformation is not about the technology adopted but the technique improved, the business transformed and the value gained (Kane et al., 2015). Neumeyer and Liu (2021) and Neumeyer et al. (2021) also argue that SME managers need to understand what digital technologies mean for their individual unit, how and when to use a technology proficiently and constantly evaluate and adapt it. According to Carr (2003), the trap to avoid is focusing on technology as an end in itself.

Digital transformation, such as shifting from physical retail sales to a digital marketplace, is a broad, deep and significant form of technological change. It involves various ongoing initiatives incorporating many interrelated actors (Solberg et al., 2020). It focuses on the process of restructuring economies, institutions and societies at a system level (Bouwman et al., 2019; Rassool & Dissanayake, 2019). Galindo-Martín et al. (2019) define digital transformation as business changes needed to adopt digital technologies, such as buying cloud storage and using email and office software and social networks. Li et al. (2018) define digital transformation as the impact of information technology (IT) on organisational structure, routines and information flow. It is a never-ending iterative process as IT constantly evolves. Companies must constantly transform themselves in response to technological changes. Solberg et al. (2020) further state that the push towards digital transformation is motivated by the belief that new digital solutions have the significant potential to drive innovation and competitive advantage. However, scant research has addressed why SME managers actively participate in digital transformation.

Measuring the ROI of Digital Technology Usage

Any potential investment initiative must be able to answer a valid question from investors: 'What is the value returned by the respective investment?' Thus, an investment is mainly based on the investors' expectations regarding the returned value (Lin et al., 2006). Investments in technology to perform a digital transformation in SMEs are no exception to this rule, as business performance strongly depends on the ability to measure one's own business efficiency (McIntosh et al., 2001). As mentioned before, SMEs'

adoption of digital technologies yields essential benefits and added value, but without a set of measurements, there is no proof that the digital technologies were well chosen and efficiently implemented in an SME's value chain.

However, evidence of digital ROI has been far from conclusive (Dehning & Richardson, 2002; Melville et al., 2004). In the literature, the impact of digital investments on the organisation as a whole has frequently been measured using variables such as market share, market performance, productivity growth and cost reduction (Bharadwaj, 2000; Das et al., 2010; Dedrick et al., 2003; Liang et al., 2010). Nevertheless, a precise standard for measuring digital ROI, especially for SMEs, is immature. This lack of measurement leads to the impossibility of proving that the investment resulted in a profit or loss (Mangiuc, 2009). McCann and Barlow (2015) also point out that calculating this ROI can be a complicated task, but any company which fails to do so will jeopardise its ability to demonstrate the total rewards of its technology usage. Thus, even if the need to measure the results of digital solutions is widely accepted, the evaluation and measurement method is still subject to debate, as it has been traditionally challenging. A significant drawback is the difficulty of financially quantifying the added value to the SME of a specific technology (e.g. cloud computing, collaboration tools, e-commerce and Industry 4.0 solutions). An ROI measurement could demonstrate that the benefits delivered by the adopted technologies can be assessed in monetary value (Mangiuc, 2009). The traditional equation used to compute and measure ROI as a percentage is as follows:

$$ROI = \frac{(Investment\ Gain - Investment\ Cost)}{Investment\ Cost}$$

Synoptically, when measuring the return on an investment, some benefits are more easily measured than others (McIntosh et al., 2001). Those benefits that are easy to quantify and define are called hard benefits (Blanchard, 2011; Crawford & Pollack, 2004; McCann & Barlow, 2015), financial or tangible benefits (Blanchard, 2011; McCann & Barlow, 2015; Pfister & Lehmann, 2021) or monetary benefits (Tarutė & Gatautis, 2014). However, not all values and benefits are measurable directly. In the literature, these are considered strategic benefits (Pfister & Lehmann, 2021; Tarutė & Gatautis, 2014), non-financial or somewhat intangible (Blanchard, 2011; McCann & Barlow, 2015) or soft benefits (Crawford & Pollack, 2004).

Financial benefits may easily be traced through the business value chain and assessed for profit or loss. To evaluate the hard or financial benefits of digital technology implementation, the researcher should identify the business process affected by these technologies and perform the necessary actions to measure the extra profit generated by the improved business process compared to the traditional version of the process (Mangiuc, 2009). In analysing the scientific literature, the following main financial benefits of digital technology adoption for SMEs can be identified:

As mentioned above, various studies also show benefits besides the financial gains – that is, soft or so-called strategic benefits. These cannot be quantified in monetary terms and include the following:

Research Methodology

Case Study Design

Case studies are recommended in exploratory research, as they are 'revelatory' for research, provide rich data and investigate contemporary managerial challenges (Yin, 2018). They are suitable for examining a broad and complex topic when theory is rare and the context is significant (Dul & Hak, 2007; Eisenhardt, 1989). This case study should offer strong practical recommendations for SMEs confronted with digitising their business. The intention is for SMEs to use the research findings to formulate a digital strategy and evaluate the possibilities of adopting various analytics solutions. These findings could be used to understand how implementation might affect their business model and provide information to correct the current strategy and business development by systematically encouraging innovation. Through a multiple-case study approach, the researchers can draw evidence from more than one unit of analysis, increase the validity of generalisations developed from the research and add both breadth and depth to the data collection (Benbasat et al., 1987; Yin, 2018). The researcher employed purposeful sampling (Kumar et al., 1993). Following the SME definition of the German Institute for SME Research (IfM Bonn, 2022), two criteria were applied in the data collection process and SME search: staff headcount below 500 employees and annual turnover below 50 million euros. The empirical data stem from eight SMEs based in Germany that implemented and used digital technology and have shown solid evidence of strong growth and innovation. First, the researchers visited 16 SMEs that had initiated or showed interest in implementing digital technologies in their supply chain. These preliminary meetings led the researchers to purposefully sample eight players that are especially relevant due to their development and utilisation of digital approaches geared towards growth (and potentially also rewards as best practice examples). Furthermore, these businesses were chosen for illustrative purposes, as the researchers sought real-life cases that support the logic of the presented concepts (Kumar et al., 1993; Siggelkow, 2007). The initial screening took approximately one day per SME. Table 3 lists the research sites compared to employees and annual revenue. It also briefly describes each SME's digital transformation to lend rich familiarity to each case and facilitate cross-case comparisons (Eisenhardt, 1989).

Data Collection and Analysis

The results are drawn primarily from in-depth interviews, along with support from online media, expert discussions, direct field observations, documentary evidence, archival records and workshops (see Table 4). Using different sources permits triangulation, allows for internal validity and bolsters the research results (Jack & Raturi, 2006; Yin, 2018). The interviews lasted between 40 and 135 minutes (53 min. on average) and were conducted between May 2020 and April 2022. Before each interview, the researchers familiarised themselves with each case by studying the company's website and consulting online presen-

Table 1. Financial Benefits of Digital Transformation

Benefit	Description	References
efficiency & effectiveness	improvement in processes, life-cycle enhancement, enhanced network capabilities, digital accounting and automated invoices, reduced payment documentation efforts, more flexibility, improved speed	Bayo-Moriones et al. (2013), Carayannis et al. (2006), Müller et al. (2018), Neumeyer et al. (2021), Neumeyer & Liu (2021), Solberg et al. (2020), Tarute & Gatautis (2014)
cost reduction	decrease in production costs and marketing costs, less maintenance required, low-cost transactions, reduced physical transportation, reduced purchasing and procurement costs	Bayo-Moriones et al. (2013), Carayannis et al. (2006), Galindo-Martín et al. (2019), McCann & Barlow (2015), Neumeyer et al. (2021), Neumeyer & Liu (2021), Solberg et al. (2020)
productivity growth	increased employee productivity, improved internal communication, improved collaboration, teamwork and networking, increases in profits, save business time	Bayo-Moriones et al. (2013), Carayannis et al. (2006), Müller et al. (2018), Neumeyer et al. (2021), Neumeyer & Liu (2021), Solberg et al. (2020), Tarute & Gatautis (2014)
competitive advantage	improved competitive position, higher quality and output, new business models	Bayo-Moriones et al. (2013), Carayannis et al. (2006), Müller et al. (2018), Neumeyer et al. (2021), Neumeyer & Liu (2021), Pulka et al. (2018), Solberg et al. (2020), Tarute & Gatautis (2014)
sales increase	increasing brand awareness, image and trust result in achieving higher sales/revenue	Neumeyer et al. (2021), Tarute & Gatautis (2014), McCann & Barlow (2015), Pulka et al. (2018), Saridakis et al. (2018)

Table 2. Strategic Benefits of Digital Transformation

Benefit	Description	References
customer satisfaction	quality improvement of products, services and information, external direct communication improvement, flexibility and speed in product delivery, trading and communication	Bayo-Moriones et al. (2013), McCann & Barlow (2015), Müller et al. (2018), Neumeyer et al. (2021), Neumeyer & Liu (2021), Solberg et al. (2020), Tarute & Gatautis (2014)
access new markets	opportunity to access new world markets and offer goods and services to a larger number of customers in different countries independent from geographical area and without a physical presence needed	Carayannis et al. (2006), Galindo-Martín et al. (2019), Li et al. (2018), Müller et al. (2018), Neumeyer et al. (2021), Neumeyer & Liu (2021), Pulka et al. (2018)
innovation development	develop and design new products, services and processes, R&D development, enhanced innovation and creativity abilities, discover new business models and opportunities	Carayannis et al. (2006), Neumeyer et al. (2021), Solberg et al. (2020)
brand awareness	build and improve brand awareness and marketing performance, improved company image/identity, improved brand recognition, high visibility	McCann and Barlow (2015), Neumeyer et al. (2021), Pulka et al. (2018), Saridakis et al. (2018)
increased security	secure private data storage, cyber security, reliable data transfer, network security, safer and transparent transactions, energy security, automated upload reduces the potential for data loss	Müller et al. (2018), Neumeyer et al. (2021), Pulka et al. (2018), Warren (2017)
employees satisfaction	increased interaction and communication tools, easy to use tools, new innovative work environments, increase in diversity and inclusion, reducing anxiety, remote work, choice of hardware for work	Bayo-Moriones et al. (2013), Neumeyer et al. (2021), Neumeyer & Liu (2021), Solberg et al. (2020), Tarute & Gatautis (2014)
environmental improvement	reduction of pollutant emissions, energy savings, ecologically optimal production process, increased sustainability, ecological and social benefits, waste savings	Müller et al. (2018), Neumeyer et al. (2021), Robinson et al. (2015), Tarute & Gatautis (2014), Warren (2017)
employees growth	facilitating labour market information (companies can hire best-trained individuals for specific tasks), creation of new job profiles and new workplaces, attract more highly skilled employees	Galindo-Martín et al. (2019), Müller et al. (2018), Neumeyer et al. (2021), Pulka et al. (2018), Solberg et al. (2020), Tarute & Gatautis (2014)
gaining knowledge	access to robust information, gaining better knowledge of customers, increasing social capital, higher information transparency with virtual processes, higher delivery reliability, adequate knowledge use	Bouwman et al. (2018), Carayannis et al. (2006), Li et al. (2018), Müller et al. (2018), Neumeyer & Liu (2021), Solberg et al. (2020)

tations, news articles and videos featuring the company in question. The interviewees have been the decision-makers in their companies, such as owners and chief executive officers (CEOs), with extensive expertise in the subject area

Table 3. Anonymous Overview of Participating SMEs

Firm	City	Industry	Products	Size (in 2019)	Brief Descriptions of SME's Digital Transformation Under Study
N1	Cologne	Manufacturing	file destruction and shredding, scanning and archiving of sensitive data	75 employees, 9 million p.a.	Founded in 1985, N1 started offering data protection-compliant destruction of files and sensitive information carriers with a nationwide presence in Germany. In 2011, the family-owned company changed it's brand and paper-heavy business model that worked for decades. Driven by the digitization and decrease amount of paper, the market and technology leader had to add further digital services such as document scanning, archiving of data and digitally signage of contracts. Today, the award-winning company digitizes 60 million documents in a year making 20% of the total revenue with it.
N2	Gelsenkirchen	Manufacturing	industrial packaging for the transport of goods	70 employees, 8.5 million p.a.	N2 was founded in 1947. The family owned business is producing safe and stable industrial packaging units for the dispatch of large-volume goods on an area of 15.000 sm. Being a reliable partner in Europe for the automotive, glass and steel industry, N2 has decades of experiences in producing wood packing systems. However, it started the digital transformation with employing a CDO in 2016. The B2B company wants to become a 90% digital business in the future and stop using paper in the office and production line.
N3	Darmstadt	Manufacturing	high-performance lithium ion battery systems	284 employees, 47 million p.a.	N3 started out of a university research group in 2008. Going public in 2018 at the Frankfurter stock exchange, N3 is gaining ongoing market share due to its specialisation of large lithium-ion-based operating systems for vehicles. Being one of the most innovative companies in Germany, the leading manufacturer is a pioneer in digitizing its value chain. This year, N3 expanded in the US building an identically constructed production plant via AR instructions due to entry restrictions for specialist during the COVID-19 lockdown.
N4	Cologne	Retail	table, living and decoration products	490 employees, 50 million p.a.	N4 was founded in April 1999. When it started to enter the digital sector with an online shop in 2007, revenues increased by 7% yoy. In 2015, the company slid into the red due to loss-making business, but turned the business from insolvency to a digital and marketing driven company. Today, N4 is being celebrated as digital pioneer and asked as consultant in the retail industry. Well known as brand and second largest furnishing chain in Germany, it increased its revenue by 20% during the Covid-19 lockdown only due to its online business.
N5	Taucha	Retail	fashion wear and style counselling	280 employees, 39 million p.a.	Founded in 1832 and still family owned in the sixth generation, N5 is one of the largest fashion retailer and style consultancy in Central Germany. In 2012, the Saxon multi-label branch started with an online shop to firstly increase the customer rate in it's stores.

Firm	City	Industry	Products	Size (in 2019)	Brief Descriptions of SME's Digital Transformation Under Study
					Today, the award-winning company increases its online revenue by 30% yoy and also developed its on consultancy and logistic app. To consequently pursue its digital strategy and transform its stationary core business with 16 branches the company founded its own digital IT subsidiary.
N6	Düsseldorf	Retail	innovative mixed spices from all over the world	85 employees, 20 million p.a.	N6 started to disrupt and revolutionise the dominated spice industry by offering more than 150 innovative, global spice mixes. Founded in a student shared flat in 2012, it firstly sold its spice mixes in the B2B sector to restaurant owners and businesses. In 2014, N6 started a multi channel strategy, by selling via an online shop, retail chains and a strong online community. Today, N6 is the largest digital spice company in Europe, making 65% of revenue online. The data driven company is known by one in four.
N7	Munich	Retail	food wholesaler	120 employees, 50 million p.a.	N7 was founded 20 years ago and is a food service for companies, restaurateurs and hoteliers. It delivers up to 50 tons of fresh products and high-end convenience from all over the world with around 40 trucks. N7 is the main supplier to the Munich Oktoberfest. By means of digital warehouse and route optimization, the company has been able to reduce the frequency of errors in picking and route accuracy by 80%. A BI tool achieves the optimal tour planning, warehouse utilization and conversion rate every day.
N8	Paderborn	Manufacturing & Retail	premium coffee systems	170 employees, 20 million p.a.	As an international coffee company based in Germany and roasting facilities in Switzerland, N8 has been on the market since 1995. With a brand range of over 47 products and 4,000 systems, N8 offers premium coffee solutions, professional machines and new trend products for the franchise gastronomy. N8 relies on intelligent digital solutions in the area of coffee supply, can automatically read the coffee levels, remotely maintain the machines, 98% of which run on a rental model, and digitally bill customers.

and have participated in information and communication technology (ICT) adoption decisions within their business. Data from 20 interviews were triangulated by examining company websites, visits to the SMEs (where possible due to the COVID-19 pandemic), industrial databases, press releases and press interviews. Table 4 shows an overview of interviews conducted, delineation of the interviewees' personal and organisational characteristics and other sources, such as official websites, brochures, presentations, published news articles, online videos, field observations and physical artefacts.

After the data collection, a within-case analysis was performed, including a detailed description of all eight cases to allow the researchers to familiarise themselves with each case before identifying common themes among the cases (Eisenhardt, 1989). The researchers described the digital transformation in all eight SMEs in terms of the digital technologies used, their adoption, the growth after their implementation and the costs and returns. These descriptions were then given to the respondents as reports to ensure the accuracy and validity of the findings. Subsequently, a cross-case analysis was conducted using pattern-matching logic (Beverland & Lindgreen, 2010; Eisenhardt, 1989). The Gioia (2013) method was used for iterative data analysis based on the theoretical background. This method is inductive and allows for continuously and systematically

Table 4. Data Collection & Overview of Interviewees

Firm	Interviews	Interviewee Function	Other
N1	3	Head of Digital Sales, CEO, CDO	a, b, c
N2	2	CEO, CDO	a, b
N3	2	Head of IT, CDO	a, b, c
N4	3	Head of IT, CEO, CDO	a, b, c, d, e
N5	2	Head of IT, Head of Marketing	a, b, c, d
N6	3	Head of IT, Controlling & Online Marketing	a, b, c, e
N7	2	CEO, Head of IT	a, b, c
N8	3	Head of IT, Head of Business Development, CFO	a, b, c, e

Other: a) official website, brochures and presentations, b) published news articles
c) online videos, d) participant/field observation, e) physical artefacts

combining empirical data and theories (Dubois & Gadde, 2002). The data analysis comprised three steps.

First, the researchers repeatedly read the interview transcripts to capture what the informants meant, conducted in vivo coding and compiled the initial coding table afterwards. The coding, which adopted Strauss and Corbin's (2003) notion of open coding, was double-checked by a peer researcher of the chair. All divergences were resolved through discussions until agreement was reached. Finally, a set of first-order concepts representing the informants' views on what was happening in each case setting (Van Maanen, 1979) was derived. Second, the researchers offered theoretical interpretations of the first-order concepts on the basis of a second-order analysis. The second step was iterative in nature and included repeated comparison and contrast to the first-order themes and comparing extant literature to themes from the derived concepts. Consequently, the second-order themes became the notions used to explain the patterning of the first-order data (Van Maanen, 1979). As the second-order themes emerged, the researchers tried to aggregate and distil the second-order themes even further into aggregate dimensions. Following Gioia et al. (2013), this is when the research transited from being inductive to abductive in that 'data and existing theory are now considered in tandem' (p. 21). For the purpose of this research, the researchers were open to using concepts identified in previous research to summarise the second-order themes and aggregate dimensions, a practice also incorporated by Pan and Tan (2011). The data structure presented in Figure 1 (see Findings) highlights the second-order themes and aggregate dimensions derived from both steps. The findings section includes more information including representative quotations for the first-order concepts and second-order themes. Finally, the researchers highlight the dynamic interrelationships between second-order and aggregate dimensions to create a comprehensive storyline to make sense of the digital return the researchers observed. From these findings, a pattern of digitally created ROI emerged for the SMEs.

Findings

Digital Value Creation

An extensive analysis of the collected data generated essential digital benefits and returns. Overall, the added value and benefits revealed in this analysis are increasing revenue, customer and employee satisfaction, efficiency (less input for output) and productivity (more work produced) (Figure 1).

Increasing Revenue

The analysis shows that increasing revenue is one of the most critical objectives of digitisation for SMEs. Using data analytics tools provides the opportunity to increase *options to sell* SME products. The option to contact customers via newsletters in the analysed buying rhythms and even optimised delivery times for mailing to improve the opening rate increases sales, as faced by numerous SMEs. Moreover, several companies indicated that they *use* the *knowledge* they have gained from customer data to raise revenue. The findings stress that SME managers individualise the online shop for customers by analysing their data. Two SME managers emphasised that their system automatically filters products according to customers' needs and interests:

> *We use data to develop tailor-made individual offerings and consult the customer in the best way.* (N5)
> *We want to address customers more directly on our website, to address them more individually. My impression is that people appreciate that. And the corresponding figures also indicate that they do. And that a vegan, for example, does not get advertising for barbecue or meat spices. That is taken for granted and should not happen in the future.* (N8)

Furthermore, by understanding and analysing real-time sales data, SMEs can make customers buy more products. The interviewees derive recommendations and make forecasts from historical developments by analysing buying rhythms, successful posts, products and sales figures. Additionally, the analysis shows that digital technologies increase *competitive advantage* and therefore revenue. SMEs can benefit from greater brand awareness, increased visibility and brand rejuvenation. An N5 manager described the

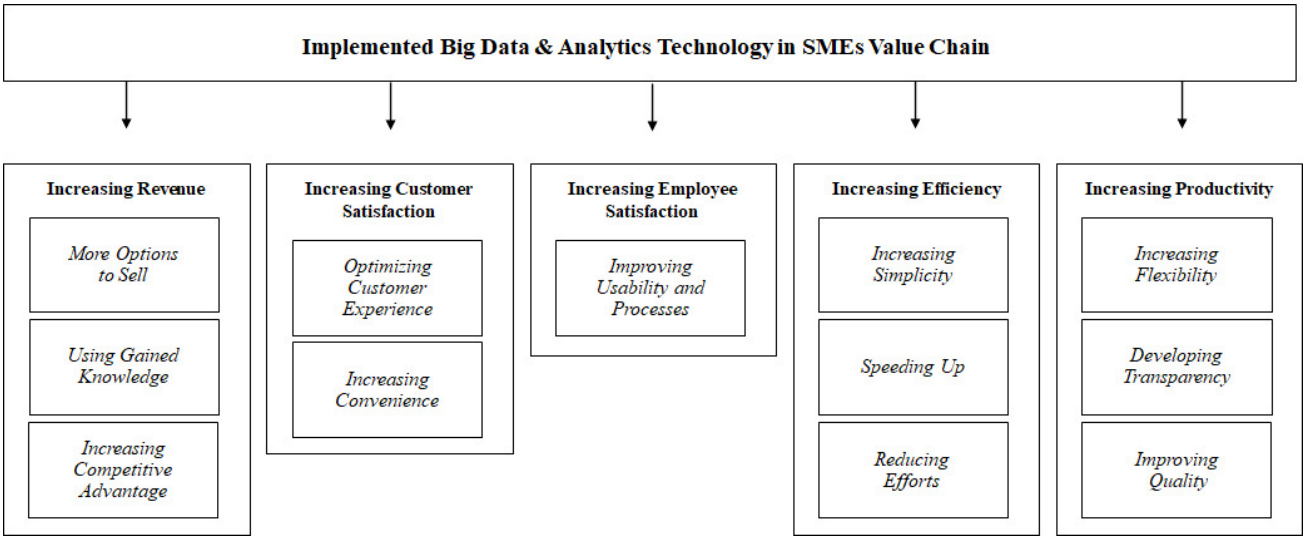

Figure 1. Digital Value Creation in German SMEs Based on Big Data and Analytics Technology

situation as follows: *'We have rejuvenated ourselves in the last three or four years. Thank goodness for that.'* The CEO of N1 added, *'We digitise to remain competitive or open up new, completely new business areas'*. Thus, another value in terms of competitiveness is the possibility of agile product development and innovation creation based on digital market research, data analysis and social interactions with customers, as several SMEs highlighted.

Increasing Customer Satisfaction

In addition to increasing revenue, the companies strived to satisfy their customers. The analysis reveals two themes relating to increasing customer satisfaction with data technologies: *experience* and *convenience*. Many SMEs implemented a product information system to provide profound information, characteristics and details of products during the buying process for certain goods and to increase the reliability of product availability with automated Enterprise-Resource-Planning (ERP) and stock tracking systems. Paired with a secure, fail-safe and performant buying experience for data privacy (e.g. staying anonymous in the buying cycle), SMEs enhance the customer experience. Today, even the digital tracking of store traffic during the pandemic allays the fear of visiting the shop and thus enhances the customer experience, as N5 highlighted. Another aspect revealed through this analysis is the *increased convenience* for customers when entrepreneurs implement big data technologies. First, all retailing SMEs provide the opportunity to check product availability online upfront. Second, all customers benefit from simple navigation through the online journey, for instance, including a fully searchable portfolio and content, convenient and secure payment methods and a simple single-sign or partner login for buying products as easily as possible. Third, SMEs use analytics technologies to increase speed in front of the customer as swifter transportation of information and customer data is possible. This means quicker checkout processes and reduced cash shortages.

Increasing Employee Satisfaction

The findings also stress that SMEs can improve employee satisfaction significantly by using analytics. Enhancing the *usability* of tools and processes makes doing the job and work more accessible and comfortable. During the interviews, all SME managers acknowledged that easier, partly automated processes increased employee satisfaction and motivation. By providing intelligent dashboards, modern and faster software and easy-to-use and intuitive tools for employees, SME managers delight and motivate their employees. An interviewee of N8 mentioned increased usability in addressing customers by providing employees with Business Intelligence (BI) dashboards with customer data to address them accordingly. In N4, employees operate the cash system nearly blindly, as it simply works with intuitive data software and a touchpad. The Chief Digital Officer (CDO) of N3 also mentioned an automatic data key to open the pool car and check-in via automated fleet management.

Increasing Efficiency

The analysis also shows that a digital transformation of SMEs tremendously drives efficiency and company performance. First, *simplicity* increases as many processes become more accessible, automated and streamlined. To some entrepreneurs, the goal is mapping systems together, reducing steps in processes and making processes more accessible. Interviewees of N3 stated that they have omitted essential steps in the invoicing process, for instance, through automated invoice software. Second, digitised processes facilitate a higher *speed* in every business area. This was reflected by all companies, which have successfully transformed processes to make them more modern and faster, ultimately improving workflows to save time: *'with the analytics system, we can assure that you get your offer much faster'* (N7) or *'[the automatic warehouse] definitely saves time'* (N6). Third, several interviewees underlined the benefits of *reducing effort* with analytics solutions, leading to higher efficiency. Commonly, the interviewees described

digital processes that decrease their effort in their value chain. N5 has reduced working steps and meeting time to collect and present key performance indicators (KPIs). This is automatically done by the BI tool today. N4 has benefited from an accounting tool that automatically books invoices. Likewise, N5 has reduced time for making calls and appointments by introducing an automatic booking system for guests. A manager of N2 emphasised that they have decreased the waste of cutting wood with data optimisation software for saws, resulting in cost-cutting of 15%.

Increasing Productivity

Finally, the analysis shows that the usage of analytics increases productivity. First, several companies indicated that analytics solutions make them much more *flexible*. For instance, being able to work remotely and access all relevant company information on dashboards to check performance or KPIs (e.g. sales figures, stock levels) helps the SMEs work more constructively. Second, the use of big data increases the overall *transparency* of the SMEs' business operations. By tracking and monitoring customer data and channels, contracts, processes, sales pipelines and costs in real time, all SMEs have increased their productivity, as they can react immediately. For instance, N5 has built its data hub to increase customer data transparency (e.g. size, preference, buying cycle), and order processes use this knowledge to make product recommendations to their customers. Similarly, N2 has a clear overview of all orders currently being processed and relies on a scanning system that relates to the ERP in the production to know the exact number of resources used. In an identical way, N5 included an algorithm in their tracking system to alert if irregularities occur. Consequently, the management can forecast different scenarios and determine when bestselling products must be reordered. The CEO of N5 revealed, *'In the dashboards, we see all current bestseller figures with product images. Meanwhile, we have a reorder rate of 30% during the season because we can now tell a supplier exactly in which quota and at which time we need bestseller articles'*. Third, and closely associated with the previous theme, numerous SMEs have increased *quality*. Five interviewees mentioned that data quality enables much more accurate calculations and company performance control. For example, N6 analyses the buying rhythms of customers and historical data to predict with high accuracy when customers will make their second or third purchase. Through this, the company can determine how many new customers can be generated at what point in the year with maximum effort and increasing reliability. Besides the increased data quality, the use of data analytics reduces manual human errors and consequently increases the company's output, as several SME managers mentioned. A respondent of N2 admitted to a reduction in miscounted resources used in the production process. Finally, quality can be improved via optimisation software on the production line to maintain plants before an error occurs or to coordinate certain gluing times and change-over processes.

Return on Investment

As mentioned initially, any potential investment, especially in an analytics technology or solution, should bring a measurable return. SME performance strongly depends on the company's ability to measure its own business efficiency, which has strong relevance due to the presence of financial bottlenecks in many cases. The findings presented above demonstrate various benefits in all kinds of business operations. However, as previously mentioned, direct, measurable evidence is lacking, and there is no KPI-based proof that the analytics tools were well chosen, efficiently implemented in the SME value chain and finally worthwhile. The analysis of the aforementioned value and benefits demonstrates that there are many scenarios in each SME for which a substantial ROI is computable, as concrete numbers for gains and costs are available. The analysis reveals that financial measurement is mainly possible in the cases of (i) increased, added or new revenue and (ii) saved costs due to reduced working time or resources (e.g. OPEX).

As presented in the previous findings section, an increase in revenue can be regarded as a gain of a particular digital solution. Ergo, an ROI is computable and attributable to a specific solution by comparing the revenue increase with the acquisition costs (CAPEX and OPEX). An example can be found in N6. The SME switched from out-of-home (OOH) to Google Analytics campaigns. Using this solution enables the managers to track the revenue and costs of each digital campaign for acquiring new customers. Spending 10 euros for each new customer in the marketing budget makes the case profitable, as the company generates 35 euros in revenue with each increment average shopping basket of new customers. Thus, the ROI is 2.5 and this solution amortises directly. N3 has generated a much higher ROI based on increased revenue using the analytics platform Xing Analytics Insights for a licence fee of 800 euros per year. The salespersons of N3 were able to contact three prospects a week and check the response rate. In 2019, the company obtained an order of 40,000 euros purely from a Xing contact and benefited tremendously from this solution. The ROI is 49 and this investment pays for itself in under a month (see Table 5). In another example, the digital ROI based on increased revenue was enhanced through the new analytics ERP implemented in the value chain of N3. This system writes an invoice or revises an offer with one click, consequently increasing the data quality rate. As the company sells 50,000 development hours a year, an increase of 10% in quality equals an increase of 10% in billed hours that were forgotten before the system was integrated. The sale of 5,000 hours at an hourly rate of 80 euros increased revenue by 400,000 euros a year. The company invests 2,000 euros a month in the ERP software (OPEX), which results in an ROI of 15.67, and due to the monthly licence fee, this solution pays for itself immediately (see Table 5).

In most cases, reduced working time due to the usage of analytics solutions is the gain of the digital investment. Thus, in this situation, an ROI is simply measurable. SME managers measure the working steps and time needed in the analogue process and compare it with the digital

Table 5. Digital ROI Computation

SME	Solution	Investment Gain	Case Derivation	Computation of ROI for Investment Projects*	ROI	PP
N1	Smart Contracting Software	Cost Cut (working time)	**G:** time needed for the preparation of quotations and contracts was reduced from 2 FTE to 1 FTE = €34,000 savings/y **C:** intelligent software solution: €1,000/y + €100 monthly service fee	$x = \frac{(€\,34{,}000 - €\,1{,}000 + 12 * €\,100)}{(€\,2{,}200)}$	14.45	1 m
N1	E-Invoicing Tool	Cost Cut (working time)	**G:** 80% of incoming invoices are approved automatically saving 2 Accounting FTEs = €140,000 savings/y **C:** machine learning system: €26,000€ initial invest (CAPEX) + €5,000 yearly invest for maintenance	$x = \frac{(€\,140{,}000 - €\,26{,}000/5 + €\,5{,}000)}{(€\,10{,}200)}$	12.73	2.5 m
N2	Optimisation Software	Cost Cut (OPEX)	**G:** reduced costs for wood due to saw optimisation: €10,000/y **C:** invest in saw optimisation system: €3,000 (CAPEX)	$x = \frac{(€\,10{,}000 - €\,3{,}000/5)}{(€\,600)}$	15.67	3.5 m
N2	Smart ERP System	Cost Cut (working time)	**G:** saving working time €900/d = €225,000/y **C:** ERP system €30,000 implementation1 (CAPEX) & €5,000 license fees/y	$x = \frac{(€\,900 * 250\mathrm{d} * 5\mathrm{y}) - (€\,30{,}000 + €\,5{,}000)}{(€\,35{,}000)}$	31.14	1.5 m
N3	Xing Analytics Insights	Revenue Increase (higher sales)	**G:** €40k revenue through order via Xing Analytics Insights account, **C:** €80€/y fee for licenses	$x = \frac{(€\,40{,}000 - €\,800)}{(€\,800)}$	49.00	< 1 m
N3	Analytics ERP	Revenue Increase (higher sales)	**G:** 10% not forgotten of 50,000h sold/y due to ERP = 5,000h sold more x €80/h = €400,000, **C:** costs for ERP €2,000/m	$x = \frac{(€\,400{,}000 - 12 * €\,2{,}000)}{(€\,24{,}000)}$	15.67	< 1 m
N3	Smart Invoicing	Cost Cut (working time)	**G:** Personnel costs of €5,122/m reduced by 50% = €2,561 x 12 = €30,732/y costs saved, **C:** initial SW costs €9,500 (CAPEX)	$x = \frac{(€\,30{,}732 - €\,9{,}500/5)}{(€\,1{,}900)}$	15.17	< 1 m
N4	ePost Scan	Cost Cut (working time)	**G:** savings of 2h/d working time for scanning daily mail = €2,000/m, **C:** ePost Scan costs €400/m	$x = \frac{(€\,2{,}000 - €\,400)}{(€\,400)}$	4.00	< 1 m
N4	Workforce Management (Atoss)	Cost Cut (working time)	**G:** savings of €100,000/y in FTE costs (2x HR FTE) **C:** hard ware components for terminals = €53k (CAPEX) + €300 license fee/m	$x = \frac{(€\,100{,}000 - \frac{€\,53{,}000}{5} + 300 * €\,12)}{(€\,14{,}200)}$	6.04	6.5 m
N4	Disposition Tool	Cost Cut (working time)	**G:** saving 2 days working time in each store = 16h x €35 x 100 stores = €56,000/w x 4 x 12 = €2,688,000, **C:** investment of €300,000 software (CAPEX) + €100,000 implementation costs + €800 server costs/m	$x = \frac{(€\,2{,}688{,}000 * 5y) - (€\,400{,}000 + 12 * €\,800)}{(€\,400{,}000 + 12 * €\,800)}$	31.81	< 2 m
N4	Accounting Software	Cost Cut (working time)	**G:** saving working time 2h x €35/d = €17,500/y, **C:** costs for accounting tool €25,000 implementation (CAPEX) + €80 server costs/m	$x = \frac{(€\,17{,}500 * 5y) - (€\,25{,}000 + 12 * €\,80)}{(€\,25{,}000 + 12 * €\,80)}$	2.37	18 m

SME	Solution	Investment Gain	Case Derivation	Computation of ROI for Investment Projects*	ROI	PP
N5	BI Purchase Dashboard	Cost Cut (working time)	**G:** reduced working hours for purchasing labels: 12h x €35/w x 60 labels x 2 (twice a year) = €50,400/y, **C:** implementation costs for the BI Dashboard: €20,000 (CAPEX)	$x = \frac{(€\,50{,}400 * 5y - €\,20{,}000)}{(€\,20{,}000)}$	11.60	4.5 m
N5	ISTA-App	Cost Cut (working time)	**G:** reduced working hours for KPI check of store managers: 4h x €25/w x 16 stores = €83,200/y, **C:** costs for BI based ISTA-App: €160,000 Implementation & Development (CAPEX)	$x = \frac{(€\,83{,}200 * 5y - €\,160{,}000)}{(€\,160{,}000)}$	1.60	23 m
N5	BI Consultancy Dashboard	Revenue Increase (higher sales)	**G:** secured 10% of the revenue during Covid-19 lockdown: €325,000 instead of €0 revenue with shops closed, **C:** costs for consultancy dashboard: €20,000 (CAPEX)	$x = \frac{(€\,325{,}000 - €\,20{,}000)}{(€\,20{,}000)}$	15.25	2 m
N6	Smart ERP	Revenue Increase (higher sales)	**G:** increase in revenue due to avoided loss of bestseller during the weekend: 52 x 1000 orders x €4 each h = €208,000 additional revenue, **C:** costs for the ERP: €50,000/y (CAPEX)	$x = \frac{(€\,4 * 1{,}000 * 52) - (€\,50{,}000)}{(€\,50{,}000)}$	3.16	3 m
N6	Web Analytics Shop	Revenue Increase (higher sales)	**G:** increase in revenue with a web tracking online shop: €1,4M/y, **C:** costs for the web analytics tracking €9,000/m = €108,000/y (CAPEX)	$x = \frac{(€\,1{,}400{,}000) - (€\,108{,}000)}{(12 * €\,9{,}000)}$	11.96	< 1 m
N6	Cross Selling Tool	Revenue Increase (higher sales)	**G:** increasing the average basket by 6.5% through knowing the buying behaviour = €0,5M/y additional revenue **C:** BI based intelligent cross-selling tool €25k/y (CAPEX)	$x = \frac{(€\,500{,}000 - €\,25{,}000)}{(€\,25{,}000)}$	19.00	< 1 m
N6	SEA Analytics	Revenue Increase (higher sales)	**G:** additional revenue with an average shopping basket (via Google Customer Journey): €35 **C:** acquiring costs via Google Analytics: €10/customer	$x = \frac{(€\,35 - €\,10)}{(€\,10)}$	2.50	< 1 m
N7	Analytics Online Platform	Revenue Increase (higher sales)	**G:** increase in revenue with an analytics online shop: €40,000/y **C:** initial invest: €5k (CAPEX) + €200/m for cloud rental & software fee = €3,400/y	$x = \frac{(€\,40{,}000) - (€\,1{,}000 + €\,200 * 12)}{(€\,3{,}400)}$	10.76	1.5 m
N7	Tour Planning System	Cost Cut (working time)	**G:** savings of 20% workforce costs through optimised routes and FTE hours: €600,000/y **C:** initial invest for truck hardware components (CAPEX): €92k + €520/m for software & license fee = €6,240/y	$x = \frac{(€\,600{,}000) - (\frac{€\,92{,}000}{5} + 520 * 12)}{(€\,24{,}640)}$	23.35	2 m
N7	Smart ERP System	Cost Cut (working time)	**G:** savings in working time (12h/d speed increase) = 240h x €35 = €8,400 x 12 = €100,800 **C:** €60k initial invest (CAPEX) + corresponding maintenance of €1k/y	$x = \frac{(€\,100{,}800) - (\frac{€\,60{,}000}{5} + €\,1{,}000)}{(€\,13{,}000)}$	6.75	7 m
N7	Predictive Analytics	Cost Cut (working	**G:** saving of €180k/y in procurement costs due to automatically forecasting partner fees with SAP Ariba	$x = \frac{(€\,180{,}000) - (€\,200{,}000/5)}{(€\,40{,}000)}$	3.50	13 m

SME	Solution	Investment Gain	Case Derivation	Computation of ROI for Investment Projects*	ROI	PP
	(SAP Ariba)	time)	**C:** one-off investment of €200k for the tool (CAPEX) incl. licenses			
N8	Dynamic Retargeting	Revenue Increase (higher sales)	**G:** additional revenue with higher churn rate and orders: €9,000/m **C:** €350/m for behavioural retargeting software per m	$x = \frac{(€9{,}000 - €350)}{(€350)}$	24.71	< 1 m
N8	CRM Analytics (Salesforce)	Revenue Increase (higher sales)	**G:** improved quality of selling process with Salesforce Analytics: €70k/y additional revenue **C:** €1k/m licenses + €30k/y developments and updates	$x = \frac{(€70{,}000) - (€1{,}000 * 12 + €30{,}000)}{(€42{,}000)}$	0.67	6 m
N8	Third Party Display Campaign	Revenue Increase (higher sales)	**G:** increase in revenue via new partner channel of €96k/m **C:** €24k for big data display campaign/m	$x = \frac{(€96 - €24)}{(€24)}$	3.00	< 1 m
				Ø ROI	**13.44**	
				Median	**11.96**	

[1]Assumption: Lifetime of investments = 5 years

For reasons of simplification, net present value calculations are not taken into account.

[2]Assumption of 250 working days a year

G = Gain, C = Cost, PP = Payback Period, y = year, m = month, w = week, d = day, h = hour

process's period. For instance, N4 implemented a smart disposition system in all stores to automatically evaluate inventory and sales data. The system then calculates store delivery of 2,500 items every night on its own. This saves two working days in each store, as the staff does not calculate deliveries manually. N4 invested 300,000 euros in the development of the software, paid 100,000 euros in implementation costs and must pay 800 euros in server costs per month. Despite this investment, the company profits from a 32-fold ROI. The system paid for itself within a few months. Likewise, N5 developed their app based on a BI dashboard. This app supports store managers in checking sales KPIs each Monday morning and therefore reduces the working time of four hours per week in the evaluation process. A CAPEX investment of 160,000 euros was needed to develop the app. However, the company reduced personnel costs significantly as store managers cost 25 euros per hour and are required in 16 branches. This results in an overall ROI of 1.6 and a payback period of approximately two years. Another analytic solution is an optical character recognition (OCR) scanning software ePost Scan that N4 uses to automatically scan, analyse, index and forward incoming mail as PDFs to employees. The manual distribution of daily mail took two hours per day, involved one employee and cost a monthly salary of 2,000 euros. The digital process costs the company 400 euros per month, requires five minutes, instead of two hours, a day and results in a positive ROI of 4 with a direct payback effect.

Table 5 shows other BI and data analytics scenarios and provides an overview where a coarse ROI is approximately calculable in all eight SMEs. The computed average digital ROI is 13.44. However, the median (M = 11.96) should be considered to compare and evaluate the different ROIs, as there are a few exceptional cases with a very high ROI distorting the average value.

Barriers and Resistance to Digitisation

Although the participating SME managers were aware of the significance of enhancing business through digital technologies, they stressed several barriers. As digital technology adoption changes the nature of work, it is not surprising that entrepreneurs have different views on digital transformation initiatives. The novelty, complexity and power of digital technology can threaten existing routines (Neumeyer et al., 2021). The analysis of all cases shows that CEOs avoid digitally transforming their business for multiple reasons. First, half the SME managers mentioned *data protection issues*, as they are uncertain where their data go and fear that there is insufficient protection from the EU's General Data Protection Regulation (GDPR). Second, employees prefer performing in familiar ways in which they feel competent (Solberg et al., 2020). The CEO of N2 highlighted, *'our employees have difficulties breaking up old-established processes they have been used to for 20 years'*. Third, the findings in several cases reveal that SME employees avoid implementing technology because they worry about the need for *fewer labour hours*, as Solberg et al. (2020) also observe. The more technology is implemented, the less there is for people to do (Solberg et al., 2020). Fourth, some SME managers resist change due to *missing personality traits and emotions*, which was conveyed through statements such as *'the USP of small companies are emotions'* (N7) and *'social media is impersonal. Selling is still a matter of interaction between two people'* (N3). Finally, the results support current research showing that SMEs fail to use technology due to a lack of resources (*'our employees are not computer-loving or proficient'* – N2), a rigid and risk-averse corporate culture (*'we have a fear of fines and doing something wrong'* – N4) and poor knowledge and know-how (*'I need someone who understands it'* – N1) (Carayannis et al., 2006). Table 6 presents an overview of all identified barriers and reasons for resistance to digital transformations.

Discussion

Two research questions were addressed in the present paper: one (RQ1) considering how SMEs digitise their business to create digital benefits and another (RQ2) regarding how these benefits can be measured and lead to a positive ROI. Concerning RQ1, the empirical results reveal the following dimensions of digital value creation: (i) increased revenue, (ii) increased customer satisfaction, (iii) increased employee satisfaction, (iv) higher efficiency and (v) productivity.

The findings illustrate a primary focus on cost-cutting (increases in efficiency and productivity) and increasing overall revenue, while customer and employee satisfaction seem like added benefits of digitising SMEs' value chains. Here, the results highlight a more nuanced perspective from the interviewees regarding reducing costs, being faster and more flexible and simplifying processes when digitising. In addition, SMEs primarily strive for more options to sell products by using their knowledge of customers and expanding their competitive advantage to increase their revenue. In terms of cost-cutting, these findings are in line with the literature, as a focus on efficiency and effectiveness as well as cost reduction can be found in numerous sources (Bayo-Moriones et al., 2013; Müller et al., 2018; Neumeyer et al., 2021; Pulka et al., 2018; Solberg et al., 2020; Tarutė & Gatautis, 2014). However, the intense focus on sales increases due to the addition of more selling options, data analytics and Search Engine Advertising (SEA) campaigns as well as deep integration of social media communities is partly presented in theory but not specifically centred (Bouwman et al., 2018, 2019; McCann & Barlow, 2015; Saridakis et al., 2018). In particular, the aspect of creating and using customer knowledge via data analytics and BI tools to individualise offerings, react in real time to sales data, activate local customers and forecast in-depth consumer behaviour to trigger purchases is mentioned in the current literature but not to the extent that it appeared in this analysis. This is due to the topicality of big data and data analytics technologies, which is still an exceptionally recent topic for SMEs.

The results further show that the SMEs sparsely intend to digitally improve the environment through energy savings, ecologically optimal production processes, increased sustainability or waste savings, as Tarutė and Gatautis (2014), Müller et al. (2018), Warren (2017) and Robinson et

Table 6. Barriers and Resistance to Digital Transformations

#	Barriers and Resistance to Digital Transformations	SME
1	Data Protection Issues (e.g. German Data Law concerns)	N1, N6, N8
2	Lack of personality and emotions (e.g. USP of SMEs are emotions, selling is a matter of interaction between people)	N1, N2, N3, N7
3	Breaking up old-established processes (e.g. feeling competent with traditional processes they are used to)	N1, N2, N4, N5, N8
4	Fear of fewer labour hours needed (e.g. technology as substitute to human workforce)	N1, N2, N7, N8
5	Lack of resources (e.g. costs as key challenge, needing expensive external support)	N1, N2, N4, N5, N7, N8
6	Lack of knowledge, know-how and own expertise (e.g. lack of imagination, expertise and motivation)	N2, N4, N5, N8
7	Uncertainty (e.g. fear of doing something wrong, questioning the implementation process)	N2, N4, N7

al. (2015) argue. N2 optimises wood waste to save costs instead of minimising pollution. Moreover, the opportunity to access new world markets and offer goods and services to more customers in different countries, irrespective of their geographical location and without a physical presence being needed, which is specifically outlined in the literature (Carayannis et al., 2006; Galindo-Martín et al., 2019; Li et al., 2018; Müller et al., 2018; Neumeyer et al., 2021; Pulka et al., 2018) as added value, seems to be more a matter of course today. However, the SMEs are interested in 'accessing the customer' and understanding their concrete behaviour, buying cycles, search actions, customer requirements and product display to improve the buying process and ultimately generate more revenue. Finally, in terms of increased employee satisfaction through data analytics, the eight cases bring to the fore added value, such as usability and communication advantages.

Plotting the cases leads to insights into how higher performance output can be reached through different pathways. The findings show that data analytics can lead to a measurable ROI. To date, research has been limited in the context of accurate figures of ROIs and a transparent, easy-to-use framework to support SMEs' investment in a data analytics solution. There have been few attempts to measure the use of social media and other technologies without a concrete, defined value (Coreynen et al., 2017; Mangiuc, 2009; McCann & Barlow, 2015). The findings of this case study fill this gap by evaluating 25 positive ROI examples based on different solutions.

However, the findings need further discussion. First, as previously shown, most ROIs are generated through decreased costs, primarily through reduced working time, personnel costs and other saved OPEX. Compared to higher sales, SMEs usually benefit more from cost savings than from increasing revenue with data analytics, at least for calculating the return. This aligns with the findings mentioned above that SMEs are reasonably interested in cutting costs when digitising their processes (Carayannis et al., 2006). Second, most of the computed ROIs are larger than 10, implying that the analysed SMEs benefit significantly more than a 10-fold return. In principle, the higher the ROI result, the more worthwhile the investment is for the SME, but as the findings demonstrate, this is strongly dependent on the digital solution, its cost and the process that is optimised. The findings reveal a clear difference between the calculated ROIs, as some analytics solutions generate a lower ROI than that of a few SMEs that have gained a high return. As previously mentioned, this is because, on one hand, different data approaches are used and, on the other hand, costs are reasonably higher in cases of a company's own developments. These relatively high investments, grounded in the development time, external agencies and IT support that are needed, lower the ROI tremendously, as can be seen in the case of N4 and N5. This is in line with literature showing that learning to use new technologies takes time and effort, as technological changes are inherently complex and require superior cognitive skills and incessant learning (Solberg et al., 2020). Consequently, the ROI becomes higher when no initial implementation investment is needed, and costs only arise due to licence fees or monthly software subscriptions, for instance, in a pay-as-you-go-model or off-the-shelf solution (Neumeyer et al., 2021), instead of high development costs. This can finally lead to a higher ROI, as found in N3 and N5. Third, the findings reveal that it is still crucial for SMEs to compute an ROI and calculate the business case of an analytics solution, as it always correlates with costs. This aligns with Coreynen et al. (2017), Gono et al. (2016) and Saridakis et al. (2018). This is reinforced by this study's finding that the computed specific ROIs are still rare (compared to the multitude of digital benefits and added value), vary tremendously and are even very low in some cases, and thus may not be worthwhile. In fact, not all solutions are worthwhile. The analysis shows that SME entrepreneurs are implementing data analytics without knowing if the solution will add substantial financial value and finally increase company performance. Entrepreneurs often ignore costs and ROIs, but the computation of a digital ROI remains indispensable.

Conclusion

Previous research has shown that SMEs are lagging in digital technology adoption. Most SME managers are not fully aware of the value of digitisation. This research elucidated how SMEs can benefit from a positive return by digitising business processes (see Table 7). It was conducted

Table 7. Main Insights for SME Managers

#	Main Insights for SME Managers
1	Digital Technology is a driver of economic growth and raises the return on investment
2	Invest in digital technologies and benefit from a return on investment of up to 13 times (average in this study)
3	Use digital technologies to achieve multiple financial benefits (e.g., efficiency & effectiveness, lower costs, productivity gains)
4	Use digital technologies to profit of various strategic benefits (e.g., customer & employees satisfaction, market access, innovations)
5	Focus on costs and calculate the ROI before investing as it can vary tremendously due to high investment costs
6	Digital ROIs are based on increased revenue (e.g., new business model, larger sales) or reduced costs (e.g., OPEX, resources, etc.)
7	The digital impact and ROI depends on the technology and process where it is implemented and not on company size or industry
8	Use standardized digital solutions (pay-as-you-go/off-the-shelf) for quick-wins in the beginning instead of tailormade costly solutions

as a qualitative multiple-case study with eight SMEs from the retail and production industries from May 2020 to April 2022. The paper provides a rich overview of digital benefits, various ROI possibilities and payback periods when using analytics and barriers and challenges SME managers face. It contributes a well-founded set of benefits to business performance and facilitates an improved understanding of digital value creation. The findings reveal five benefits: increased revenue, improved customer satisfaction, improved employee satisfaction, efficiency and productivity. In addition, the eight case studies evince a significantly positive ROI in numerous use cases where digital solutions are implemented to improve revenue or cut costs. The weighted ROI average of these companies is 13.44. However, the median is 11.96. Thus, most of the investments are highly worthwhile. The findings support current research arguing that technology is a driver of economic growth, raises the ROI and increases efficiency and effectiveness (Carayannis et al., 2006; Neumeyer et al., 2021; Solberg et al., 2020).

Theoretical and Managerial Implications

This paper enriches the literature on digital transformation. The findings are relevant for those in academia who aim to understand the core values and returns of digitising the business model and how adopting technology can create value. One *theoretical implication* is that the study provides insight into several potential pathways for SME managers to increase their business performance through big data and analytics. The study shed light on this complex issue by showing recent use cases and adoption possibilities, thus presenting the current state of the latest sophisticated analytics solutions used in SME value chains. Although many previous studies on digital value creation have focused on implementation, usage and benefits, this study took a different angle and demonstrated the need to focus on the costs of digital solutions by measuring the ROI when using analytics technology. Hitherto, the focus in the literature has primarily been on the added value of technology adoption, as highlighted in the literature review. The contribution of this study is in stressing the need for an ROI computation and showing concrete examples of how SMEs generated a positive ROI by increasing revenue or saving costs with analytics technologies.

In addition to the theoretical contribution, the findings have exciting and challenging *managerial implication*s. The research has substantial practical relevance for SME managers and offers concrete guidelines for entrepreneurs seeking to increase their business performance by digitising their business model. This study untangled and integrated analytics technologies that SMEs can use to improve business operations. The findings show several opportunities for SMEs to innovate their business models. Therefore, this multiple-case study offers strong, appropriate suggestions and experiences for managers to systematically encourage innovation by demonstrating concrete examples of data analytics solutions, use cases, inspirations and benchmarks of other companies. It also demonstrates a level or status of using data from other companies to compare with and learn from. It further motivates SME managers to drive digitisation internally as the findings show that adopting digital solutions is worthwhile. This greater transparency and knowledge of business processes supports SME managers in formulating their digital strategy. Additionally, since the implementation of data analytics tools is often costly and SME managers are afraid of investing in them, this paper offers strong examples and practical insights into the necessary investments, costs of development and implementation and, finally, the positive return. This study's case illustrations offer concrete examples of such ROIs and expected payback periods along with the context and way they were applied. However, the findings indicate that SME managers need to be aware of the variation of ROIs depending on each use case. Exceptionally high investments into the development and implementation of tailor-made analytics use cases are costly and consequently lower the ROI. Thus, this study's recommendations for participating in the digital benefits are to start with standardised use cases and monthly subscription ('pay-as-you-go' and 'off-the-shelf') solutions with an immediate return when SMEs begin to digitise.

Limitations and Further Research

This study is not impervious to limitations. First, the study faced limitations due to the context-laden nature of qualitative research. The qualitative nature of the research does not allow generalisability. Therefore, it will be essential to research other companies to verify the results. However, the findings from eight different SMEs converge on the digital value and returns they created by adopting data analytics. Further quantitative research is needed to develop and test hypotheses regarding, for instance, the impact of analytics technologies on SME business performance and growth, and the success of investments in terms of their concrete ROI. Second, the research was conducted in the unique economic context of Germany, where all either SMEs are based. Thus, the findings might be unique to Germany's particular social and economic market situation. Similar research in different regions and countries is needed to test the validity and generalisability of these findings. A third limitation arose from the fact that some return examples were presumed. Although this study revealed various means of value creation and benefits, not all were measurable. Thus, this study lacks an ROI for all analytics tools used in the presented SMEs. More concrete, measurable ROIs should be conducted to develop further return examples. As a fourth limitation, the cases and calculations were presented after the implementation was done. Thus, the question arises as to what costs arise in building the required capabilities, which is the common enabler of several integrations. Investigating cases from a pre-implementation stage will lead to other expenses, for instance, scouting, qualification, skills and training or reorganisation costs, as Li et al. (2018) finds. Further research from an earlier stage should be done to verify this assumption.

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