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Big Data Analytics as a Necessary Instrument for the Banking Sector in the Age of Digitalization

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Abstract:

Digitalization is confronting the German banking sector with far-reaching structural challenges. In this context, this paper examines the strategic relevance of big data analytics (BDA) for banks in Germany. The aim of the paper is to analyze whether BDA is a fundamental tool for ensuring competitiveness in the digital age. Based on a comprehensive literature review and the application of the VRIN model and Porter's five forces model, BDA is evaluated as a strategic resource. The results show that BDA offers significant added value: it enables a more precise customer approach, the optimization of internal processes and improved risk management. At the same time, BDA is an answer to the growing competitive pressure from fintechs, changing customer requirements and technological substitutes. The analysis concludes that BDA is not just a technological option, but a business-critical necessity for German banks. In order to sustainably exploit the potential of BDA, technological, regulatory and cultural challenges must be taken into account. The results of this article can be useful for researchers and decision-makers in banks in order to identify and utilize the potential of BDA at all levels of an organization.

Keywords:

Big Data Analytics, Digitalization, German Banking Sector, Five Forces Model, VRIN Model

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Introduction

Overall, the German banking sector is one of the largest in the world. The structure of the German banking system is unique and traditionally consists of three pillars - the private-sector banks, the public-sector savings banks and the cooperative banks. Only the Austrian banking system has a similar structure in Europe (Behr & Schmidt, 2015; Frank et al., 2014; Komorowski, 2020).

Currently, the banking sector is facing a profound transformation that is largely driven by digitalization and technological advances. Also, retail banks are impacted by this. The gradual shift in the use of the stationary channel (bank branch) towards online banking and mobile banking by customers and the continuing cost pressure have led to a streamlining of the branch network (Deutsche Bundesbank, 2023). Today more than 80 per cent of Germans do their banking online and the smartphone is the leading tool to online banking. Nevertheless, digital services are more important to customers than the brand, customer support or branch network (bitkom, 2023; Menrad, 2020). At the same time, the number of employees has been falling steadily for years and a trend towards staff reductions can be seen across the banking industry (Giebe et al, 2022; Statista, 2023). In addition, new competitors such as fintechs (financial technology companies) are entering the market and presenting traditional financial institutions with the challenge of adapting (Gai et al., 2018; Lee & Shin, 2018).

Data is often described as the most important resource of the 21st century and to date banks have gathered a significant amount of data. This is because banks collect vast amounts of data due to their extensive transactions, customer relationships and regulatory obligations. However, only a few banks have the ability to process and utilize data effectively. Many banks also endeavor to develop this capability, as it offers major competitive advantages in the market (Albrecht & Schlüter, 2022; Deutsche Bundesbank, 2023). The term Big Data Analytics (BDA) has been introduced to describe topic overall. BDA refers to the systematic collection and analysis of large and complex amounts of data and the development of a statistical model in order to make informed decisions and gain strategic advantages (Damaschke & Giebe, 2020; D'Onofrio & Meier, 2021; Giebe, 2022).

For this reason, the following research question is to be answered in the context of this research: Is BDA a fundamental instrument for German banks?

Methodological Approach

The authors have opted for the following methodological approach. First, a literature search was conducted which involved accessing scientific sources, book chapters and internet sources for a practical component. In the literature search via google scholar, EconBiz, ResearchGate and perplexity. The search terms used were Big Data Analytics n Banks Germany, Digital Transformation Banking Germany, Five Forces Model and VRIN Model. A total of 73 sources were shortlisted, of which 43 were

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deemed unsuitable. Overall, the research is based on findings from 16 scientific journals, one book, five book chapters, five working papers, two press releases and one statistical data set. With the help of the selected sources, the situation of big data analytics in the banking sector, the digital transformation at German banks and a strategic reference could be examined and developed.

Second, the facts obtained were applied to the VRIN criteria (Value, Rarity, Imitability, Non-substitutability) in order to be able to evaluate BDA as a strategic capability (Barney, 1991). Third, Porter`s competitive forces method was used for assessment (Porter, 2008).

To answer the research question, this essay analyses whether BDA is an indispensable instrument for banks in the age of digitalization and to what extent data-driven solutions can help banks to meet the challenges of digitalization. The strategic aspect of BDA for German banks is of great importance in today's digitalized financial world.

The thesis by the authors argues that, based on the environment and framework conditions for banks described above and after analyzing the competitive forces, the use of BDA is essential for Germany as a banking centre. The use of BDA enables banks to meet the challenges of digitalization and secure their long-term competitiveness in a dynamic environment.

Literature Review

As part of this work, numerous academic and practical sources were evaluated that address key aspects of digitalization, big data analytics and strategic positioning in the German banking sector.

Big Data and Analytics in the Banking Sector

A particular focus is on the role of big data analytics in the financial sector. Key works such as McAfee et al. (2012) and Provost & Fawcett (2013) provide fundamental insights into data-driven decision-making and the management revolution through big data. Gupta & George (2016) and Côrte-Real et al. (2017) complement this perspective with the development of analytical capabilities in organizations and the business value of big data. Giebe et al. (2022, 2023), Damaschke & Giebe (2020) and Hock & Giebe (2022) focus explicitly on the use of big data in the Sparkassen-Finanzgruppe. These studies show how data analyses can contribute to customer loyalty, increasing efficiency and redesigning the business model. D'Onofrio & Meier (2021) also offer practical case studies on the implementation of analytical approaches. Deloitte (2023) and Albrecht & Schlüter (2022) emphasize the importance of customer journey analytics and data-based personalization in banking in their analytical perspective.

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Digitalization and Transformation

The digital transformation of the banking industry is another key topic. Gai et al. (2018) and Lee & Shin (2018) provide a comprehensive overview of the FinTech ecosystem and the challenges facing traditional banks. In conjunction with this, Menrad (2020) and Komorowski (2020) describe the developments surrounding omnichannel banking and the digital strategy of savings banks. Fenech et al. (2019) shed light on the changes in human resources during the digital transformation, while Frank et al. (2014) examine the impact on skills profiles in the banking sector. Bitkom (2023) and Deutsche Bundesbank (2023) provide current data on the use of digital channels and the development of the bank branch landscape. They show that older target groups are increasingly accepting digital offers - a key aspect for strategic marketing and sales concepts.

Strategic Perspectives and Competition

The theoretical foundation is provided by Barney (1991) with his Resource-Based View (RBV) and Teece et al. (1997) with the concept of dynamic capabilities, among others. These approaches help to understand digital capabilities and data expertise as sustainable competitive advantages. Porter (2008) provides a further strategic framework for analyzing the market with his five competitive forces. McKinsey (2021) and Boston Consulting Group (2018) analyze the market position of German banks and emphasize the need for personalized services and technological innovation to retain customers.

Practical Implementation and Customer Focus

Giebe & Hartig (2023) and Giebe, Löffler & Menrad (2022) look at the use of social media and the changing role of bank advisors in the digital age. They show how communication and customer interaction need to be rethought. Ali et al. (2021) also shed light on how predictive analytics can be used to pursue not only economic, but also ecological and social goals - an aspect that is becoming increasingly relevant in the context of sustainable banking strategies. The works analyzed unanimously show that big data analytics, digital transformation and strategic resource management are key success factors for banks in the digital age. Particularly in the context of the Sparkassen-Finanzgruppe, data-based innovations and customer-centred communication strategies are key levers for future competitiveness.

Results and Discussion

BDA as a Strategic Capability (Dynamic Capabilities)

It is important to align the company's capabilities with new technologies. The focus should be on the company's internal processes. Consideration should also be given to how these technologies are

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applied and how they can evolve. The competitive advantage lies in the integrative approach of dynamic capabilities (Ali et al., 2021; Provost & Fawcett, 2013; Teece et al., 1997). Such dynamic capabilities are also advisable for BDA activities. In order to analyze BDA as a strategic resource and examine whether it offers a competitive advantage according to the VRIN criteria, the individual key criteria are considered below (see figure 1).

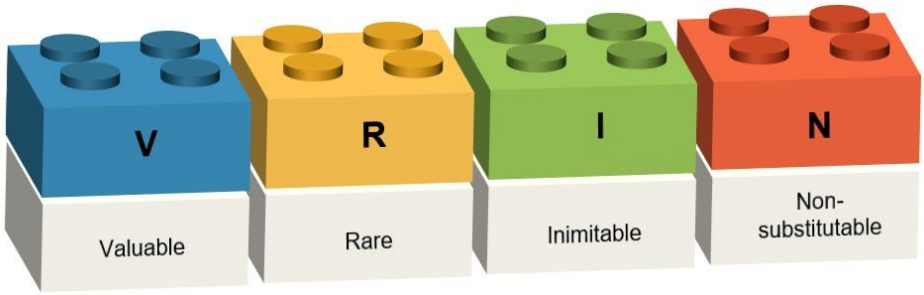

Figure 1: VRIN – Model (Own illustration)

Value: BDA enables banks to efficiently analyze large amounts of customer data and is extremely valuable as it provides deeper insights into customer behavior. This leads to improved decisions in areas such as lending, risk management and personalized marketing and increased customer satisfaction. It also enhances operational efficiency and reduces costs (Deloitte, 2023; Hock & Giebe, 2022).

Rarity: Although many banks have access to data, the ability to utilize data effectively is rudimentary. The use of advanced algorithms and the availability of specialized data scientists are key factors limiting the effective use of BDA. Smaller banks in particular often do not have the resources to develop systems comparable to those of large banks (Albrecht & Schlüter, 2022; Hock & Giebe, 2022).

Inimitability: The integration of BDA into banking processes requires considerable investment in technology, expertise and time. In addition, the underlying algorithms and models are often complex and proprietary. This makes it difficult for competitors to develop similar capacities in the short term (Côrte-Real et al., 2017; Hock & Giebe, 2022; McAfee et al., 2012).

Non-substitutability: There are no direct alternatives to BDA that offer comparable advantages in terms of speed, precision and scalability. No other tool offers a similar range of possibilities for improving efficiency, risk management and customer loyalty. Even traditional data analysis methods cannot completely replace BDA (Damaschke & Giebe, 2020; Giebe, 2022; Hock & Giebe, 2022).

The evaluation of BDA using the VRIN criteria emphasizes its strategic relevance and the potential to create sustainable competitive advantages. However, the actual value of BDA only unfolds in the context of the specific market and competitive conditions in which the banks operate. In order to fully understand

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the strategic role of BDA, it is therefore crucial to analyze the competitive forces in the German banking sector. Porter's five forces model provides a suitable framework analyzing how banks can overcome external market challenges through the targeted use of BDA as a strategic resource.

Big Data Analytics as a Response to Competitive Forces

As can be seen, banks are facing intense competitive forces in an increasingly digitalized and data-driven world. The traditional competitive forces (see figure 2) defined by Michael E. Porter have taken on new dimensions through technological innovations and the increased use of data analyses. This section looks at how BDA is influencing competitive conditions in the banking industry. For each dimension of the forces, we look at how BDA as a strategic instrument helps to strengthen market position and secure competitive advantage in a constantly changing competitive environment.

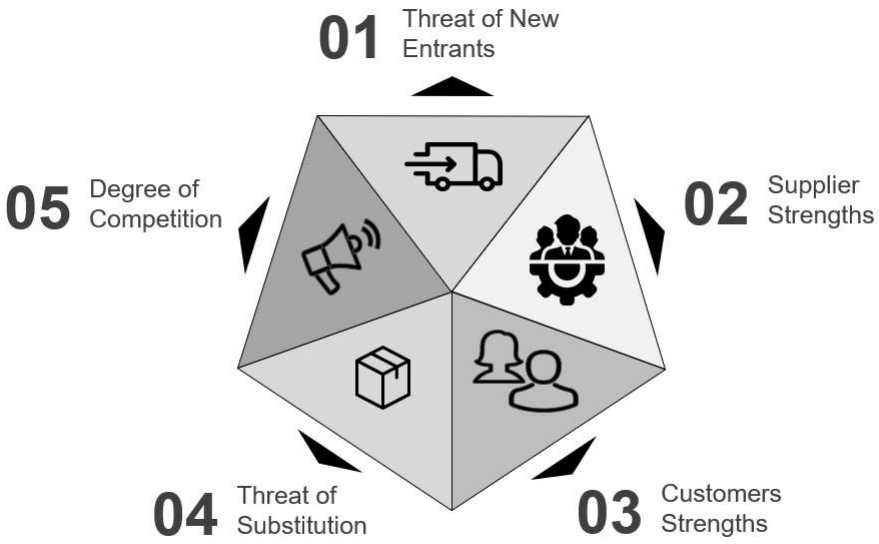

Figure 2: Five Forces Model (Own illustration)

Competition among existing banks: The German banking sector is highly fragmented and characterized by intense competition between major banks, savings banks and cooperative banks. Digitalization and the market entry of new players such as fintechs are further intensifying competition (McKinsey, 2021). BDA enables differentiated offerings through personalized services and improves the efficiency of internal processes, whereby strengthening the position of banks vis-à-vis competitors (Hock & Giebe, 2022; Komorowski, 2020). BDA also enables data-driven efficiency gains and targeted customer approaches, which reduces costs and increases closing rates. Banks can react more quickly to market changes through automation and analyzes and thus gain a competitive advantage. As a result, BDA

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mitigates the effects of intense rivalry by allowing banks to combine differentiation and cost leadership (Damaschke & Giebe, 2020; Giebe, 2022).

Threat from new market players: Technologically savvy fintechs are entering the banking sector, often with data-driven business models. They benefit from lower regulatory hurdles and agile technology. These are used to offer personalized services efficiently (Giebe & Har-tig 2023). By using BDA, established banks can develop innovative products that compete with the offerings of fintechs and adapt more quickly to market changes. In particular, BDA makes it possible to use data-based insights to keep pace with the speed of innovation of new providers. Through personalized customer approach and automation, BDA reduces costs and improves competitiveness. BDA lowers the barriers to entry by enabling banks to establish digital and data-driven business models in order to be competitive (Damaschke & Giebe, 2020; Giebe, 2022).

Bargaining power of customers: Customers are increasingly demanding personalized services and seamless digital user experiences. Their loyalty is often low, forcing banks to offer additional added value. Customers also have more power thanks to digitalization and comparison portals, as they can easily find alternative providers (Boston Consulting Group, 2018). BDA helps banks to precisely identify customer needs and offer customized products, which should strengthen customer loyalty and reduce churn to competitors. Furthermore, the closed-loop approach offers end-to-end customer communication across all channels. The closed-loop approach is a continuous, data-driven process in which customer interactions are analyzed and individual actions are derived. These measures are implemented, and the results are then fed back into the analysis. The aim is to continuously optimize efficiency and customer loyalty. As a result, BDA reduces the need for customers' bargaining power by better meeting their expectations through data-driven personalization (Damaschke & Giebe, 2020; Giebe, 2022).

Negotiating power of suppliers: In the banking sector, the main suppliers are technology providers, particularly around BDA. The negotiating power of these providers is increasing, as specialized technologies such as AI-based analyses are becoming increasingly indispensable. Banks that invest in their own BDA infrastructure reduce their dependence on third-party providers and strengthen their negotiating position. Dependence on external providers is thus minimized by utilizing in-house analysis tools and data-driven models (e.g. decision trees or neural networks). The utilization of an internal data pool of 50 million customer data alone is a unique selling point of the Sparkassen-Finanzgruppe. Overall, BDA strengthens the banks' position vis-à-vis technology providers, as they can utilize their own data and analysis capabilities (Damaschke & Giebe, 2020; Giebe, 2022).

Threat from substitutes: Alternative financing and payment models such as crowdfunding or cryptocurrencies are challenging traditional banking services. BDA offers the opportunity to integrate

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innovative data-driven services and thus counteract competition from substitutes (Hock & Giebe, 2022). BDA offers the opportunity to recognize trends at an early stage and offer suitable alternatives before substitute products from other providers become a serious threat. In addition, BDA can be used to develop innovative products based on data in order to develop your own replacement products. BDA thus minimizes the threat posed by substitute products by promoting innovations based on big data and ensuring the relevance of traditional banking products (Damaschke & Giebe, 2020; Giebe, 2022).

Conclusion

Big Data Analytics (BDA) has emerged as a key technology enabling banks to maintain competitiveness while fostering innovation and growth. Classified as a strategic resource under the VRIN framework, BDA serves as a critical lever for navigating an increasingly digitalised banking environment marked by low margins, disruptive technologies, and evolving customer expectations.

A core strength of BDA lies in its capacity to generate deep insights into customer behaviour, facilitating the development of personalised products and services—thus enhancing customer loyalty. Simultaneously, BDA supports the optimisation of internal processes and the enhancement of risk management, for instance through more accurate credit assessments and fraud detection. The integration of artificial intelligence (AI) and machine learning further amplifies the potential of BDA, unlocking new dimensions of efficiency and competitive advantage.

BDA should therefore be regarded as a transformative force in the digital transformation of the banking sector. Data-driven business models are poised to become increasingly central to competitive strategy. However, these opportunities must be balanced against significant challenges. Issues of data protection, data sovereignty, and the transparency of BDA models are essential for ensuring responsible and sustainable implementation. Regulatory frameworks such as the AI Act and the General Data Protection Regulation (GDPR) underline the need for compliance, demanding that banks strike a careful balance between innovation, information security, and public trust.

However, in addition to technological change, banks must also master cultural change within their organizations. It is important to note that success depends largely on the overall BDA capability of the organization. This includes the knowledge of the people involved, collaboration and knowledge sharing, the availability of infrastructure and data as well as established methods for recording and processing (McAfee et al, 2012).

Ultimately, this requires high investment in personnel development, training and coaching to promote the acceptance of new technologies and accelerate the implementation of data-driven solutions. Personnel development measures are fundamental to implementation. In the age of digitalization, the staff should play an active role. This is the only way to meet current and future digitalization needs

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(Fenech et al., 2019; Gronau et al., 2016). In addition to the investment in basic resources required for BDA projects, the companies need staff with knowledge of BDA technology and management skills to carry out the projects effectively (Gupta & George, 2016).

Practical implications:

- **Strategy development**: BDA must be understood as an integral part of the business model and strategically anchored.
- **Data-based customer orientation**: Use of BDA to develop personalised products and strengthen customer loyalty.
- **Promote personnel development**: Training, coaching and qualification measures are essential for the successful use of BDA.
- **Regulating and ethical requirements must be considered**: Implementation of data protection, IT security and ethical guidelines for the use of AI.
- **Cultural change must be supported**: Fostering an open, data-driven corporate culture that shares knowledge and supports change.
- **Infrastructure must be built**: Ensuring data quality, availability and powerful analysis platforms.

Theoretical implications:

- **BDA as a VRIN resource**: Theoretical underpinning of BDA as a valuable, rare, difficult-to-imitate resource that can be used organisationally.
- **Connection between technology and organisational development**: Realisation that technological innovations remain ineffective without cultural change.
- **Inclusion of ethical perspectives in digitisation research**: The need to examine the interface between technology, responsibility and trust more closely.
- **Interdisciplinary approach necessary**: Research on BDA requires the collaboration of business informatics, ethics, law and management sciences.

To summarize, BDA can be seen as an essential instrument for German banks to remain competitive and innovative. However, its success depends on a holistic strategy that integrates BDA into core business models. In the digital age, BDA is no longer optional but a necessity, requiring clear strategic direction, regulatory foresight, and investment despite financial pressures. Looking ahead, technology offers great potential for progress, but ethical considerations must not be overlooked. As AI and BDA increasingly influence decisions, questions about responsibility and transparency become crucial. It is essential to critically reflect on the ethical use of these technologies to ensure they serve people, not just efficiency.

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