

Ulrich-Diener, Florian; Dvouletý, Ondřej; Špaček, Miroslav

Article

The future of banking: What are the actual barriers to bank digitalization?

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The future of banking: What are the actual barriers to bank digitalization?

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Florian Ulrich-Diener^{id}, Ondřej Dvoouletý^{id}
and Miroslav Špaček

Abstract

The banking sector must confront challenges arising from globalization, the demand for new business models (BMs), increasing regulation, and ever-advancing digitalization. In this context, innovative competitors, namely FinTechs, are challenging banks and forcing them to rethink existing strategies and structures. In particular, the digital transformation of BMs that have been in place for decades represents a major challenge for companies and their executives. In this article, 407 German bank representatives were surveyed to identify, quantify, and analyze implementation barriers in the context of bank digitalization from a decision-maker's perspective. By applying structural equation modeling, the authors quantified a variety of barriers and tested their influence on the degree of digitalization at banks. The study uncovered structural relationships between barriers expressed as observed variables—*personal involvement, strategic corporate management, technology and regulation, and employees*—and the degree of digitalization as a latent variable of banks. The findings increase bank practitioners' understanding and awareness of barriers to digitalization and contribute to the field of bank digitalization.

JEL CLASSIFICATION: G21, M1, O33

Keywords

Banks, barriers, decision-makers, digitalization, financial services, transformation

Introduction

Digital transformation and the adoption of new technologies have increasingly raised questions about changes that traditional companies and their management must strategically face (Fernandez-Vidal et al., 2022; Hess et al., 2016). Digitalization has influenced internal and external perspectives concerning strategic direction, competitiveness, business models, decision-making, innovation, entrepreneurship, and business performance, as well as customer relations (Aydalot & Keeble, 2018; B. Cohen et al., 2017; L. Li et al., 2017). To cope with market-driven changes, such as the increased digitalization triggered by the recent COVID-19 pandemic (Faraj et al., 2021; Rivera-Prieto et al., 2022), companies must adapt even faster to their environment by rethinking and, if necessary, reforming their traditional principles (Benz et al., 2021; Davidsson et al., 2021; Dvoouletý et al., 2021; Gomber, Kaufmann, et al., 2017; Hundt & Grün, 2022; Maicas, 2023; Rietmann, 2021).

Within the past few years, several new digitally driven business models emerged in various sectors, including banking (Gimpel et al., 2016; Lee & Shin, 2018; Yang & Wang, 2022). So-called financial technology companies (known under the acronym FinTechs) are new technology-based businesses that aim to compete with traditional financial market participants. They are also seen as a pure technology seeking to improve and automate the delivery of financial services (Schueffel, 2016).

Today, financial services are particularly exposed to additional pressure from (1) forthcoming market regulations

Faculty of Business Administration, Prague University of Economics and Business, Prague, Czech Republic

Corresponding author:

Florian Ulrich-Diener, Faculty of Business Administration, Prague University of Economics and Business, nám. Winstona Churchilla 1938/4, 130 67 Prague, Czech Republic.

Email: florian.diener@vse.cz



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(e.g., Basel III/IV, Solvency I/II, Sustainable Finance Disclosure Regulation, Corporate Sustainability Reporting Directive, etc.), which are expected to increase costs (Weitert, 2014); (2) increasing competition with global market participants that enter the financial services arena (e.g., Apple, Amazon, Google, etc.); and (3) changes in customer behavior and the demand for traditional financial products and services (Diener & Špaček, 2021). In their recent qualitative study, Diener and Špaček (2021) provided insights of bank managers into the numerous hurdles to overcome regarding digitalization in the banking sector. While this former work by Diener and Špaček (2021) identified the main barriers to digital transformation in a specific part of the German banking system from a qualitative perspective, the current article dives deeper into the issue and illustrates quantifiable relationships among the observed variables and their underlying latent constructs. The combination of qualitative and quantitative approaches to digitalization barriers identification complements each other.

It is striking that financial services have become increasingly digital (Jünger & Mietzner, 2020). However, the main problem remains that all-encompassing and rapid digitalization is not equally possible at every bank. Today, digital competitors with innovative concepts, products, and services address customers in multiple ways, especially using a modern multi-channel approach to sales, communication, and marketing (Cortiñas et al., 2010). Dorfleitner & Hornuf (2016), Dorfleitner et al. (2020) observed the growing influence of these business models on development in the financial industry, including an increase in market share.

For companies seeking a sustainable competitive advantage, efficiency, innovation, and persistence are the most critical strategic factors for success or failure (Lamata et al., 2003). Meanwhile, many banks and their decision-makers recognized the need for institutional changes to cope with developments and began rethinking and/or reforming their strategy (Braun, 2016; Mohan, 2015; Nagy et al., 2016).

Building on findings like those of Diener and Špaček (2021), highlighting managerial perspective on barriers to bank digitalization, and Chhaidar et al. (2022), noting the positive effects of digitalization, it seems more important than ever before to focus on barriers to digitalization in banking. Since executives have a significant influence on their organizations, including their strategic orientation, and future success (Curi & Murgia, 2018), this study particularly aims to examine digitalization from a decision maker's perspective, as well as to quantify barriers to digitalization. Thus, the following research questions (RQs) were developed:

RQ1: What are the barriers to digitalization in an increasingly technological banking environment?

RQ2: What effect do barriers to digitalization have on the degree of digitalization of banks from a decision-maker's perspective?

By focusing on changes in the financial services market, this study provides a detailed analysis that addresses the digitalization of banking from a broader perspective, including the transformation of the industry, and decision-makers understanding of the degree of digitalization of banks related to their wider surroundings. As a result, we address a significant issue in the technological development of banking, intending to observe new evolving business models and technologies.

The forthcoming sections summarize the literature to date and existing evidence on digitalization in the financial sector, focused on the banking industry. The literature inspired the formulation of the leading hypotheses to be tested. The data collection procedures taken in 2020 toward reaching our sample of German bank representatives ($N=407$) are described in detail in the following section, as well as an analytical approach relying on structural equation modeling (SEM) as the primary method. Subsequently, the analysis results are presented and discussed from both practical and theoretical perspectives. Finally, the study's limitations and future research directions are described.

Literature review

Changes in banking due to digitalization

In light of increasing digitalization, scholars assume that digital technologies will profoundly change existing structures and the general world of work (Fedorets et al., 2021). These technology-driven developments affect both national and international banking markets, historically characterized by their evolved organizational structures (Deutsche Bundesbank, 2022, pp. 88–129; Dörry, 2022; Goddard et al., 2007; Knafo, 2022).

In this respect, “digitalization” refers to the process of transforming analog or physical forms of information into digital ones, whereas “digitalization” refers to the transformation of industries, business models, and processes. In recent decades, digitalization has enabled direct and indirect transformation in the finance industry (Hanafizadeh & Amin, 2023; Shcherbatykh et al., 2021). Today, digital transformation appears as a compelling process of change to which individuals and entire organizations must face and respond (Vey et al., 2017). This is a process of using digital technologies to create new business processes, corporate cultures, ways of working, customer experiences and offerings, or to change existing ones to meet changing business and market demands (Hess et al., 2016; Nadkarni & Prügl, 2021; Parviainen et al., 2017, p. 64).

Information and communication technologies are probably the most important factors influencing digital change, triggering it both actively and passively (Wan, 2006, pp. 1–3). Allen et al. (2002) mentioned that the modern finance industry provides services via electronic communication and computation. Digitalization, however, is more than the mere understanding that an industry or a company is changing at a technological level. Rather, it is a holistic approach to innovative processes in banking and has multiple drivers (Alt, 2016, pp. 30–32; Dorschel, 2018; Kitsios et al., 2021; Manz, 2018, p. 175; Naimi-Sadigh et al., 2022; Strietzel et al., 2018, p. 28).

Ohlert et al. (2022) revealed that different sectors of the economy are at various stages of development, with financial services being among the most advanced. Digitalization has accelerated rapidly in recent years and significantly impacts how banks operate and provide their services in the future (Niemand et al., 2021). One crucial aspect of digitalization in banking is the development of new business models and products. It is more than online banking; it is the technology-based development of companies offering innovative financial products and services, nowadays often enabled by the use of technologies such as blockchain or artificial intelligence (Rahman et al., 2021; Valero et al., 2020).

Another important aspect of digitalization in banking is the automation of processes. Many banking processes are automated using technologies such as *Robotic Process Automation* or *Machine Learning*, resulting in higher efficiency and lower costs (Villar & Khan, 2021). In particular, the accelerated development driven by the COVID-19 pandemic led to significant changes in the banking market (Flögel & Gärtner, 2020; Guang-Wen & Siddik, 2023; Romdhane, 2021). Therefore, banks had to accelerate their in-house development of innovations in order to keep up with competitors in the future (Barra & Ruggiero, 2022). This requires developing modern solutions, although strategic partnerships and cooperation between banks and technology companies or their acquisition are also needed, from which both sides can benefit (Bellardini et al., 2022; Hornuf et al., 2021; Horváth et al., 2022; Kwon et al., 2023).

It seems evident that digitalization accelerates developments in banking and responds to changing customer behavior (Menrad & Varga, 2020; Oehler et al., 2021; Reichstein et al., 2019; van der Cruijsen & Diepstraten, 2017). This is reflected in rapidly growing online markets and increasingly individualized customer offerings (European Banking Authority, 2021; Statista, 2021c). In the future, it can be assumed that digital banking in all its forms will establish itself even more rapidly in the market. (EHI Retail Institute, 2019; Menrad & Varga, 2020; Wewege et al., 2020).

Since technological change is often associated with potential disruption (Christensen & Bower, 1996),

decision-makers often hesitate to develop and implement digital solutions and new business concepts (Moschko et al., 2020; Oks et al., 2016). Breidbach et al. (2020) identified management challenges in digital transformation by analyzing 1,545 articles related to financial technology and innovative business models in financial services. They emphasized the complexity of digital systems; the orchestration of value creation through cooperation with FinTechs; and the development of elastic infrastructures, models, and markets.

Iheanachor and Umukoro (2022) confirmed that partnerships play a crucial role in unlocking the enormous potential of digital financial services. Accepting the technology itself is a prerequisite to implementing a digital strategy and digitalization (Filotto et al., 2020). Jorge et al. (2019) were the first to analyze bank managers' understanding and the impact of digital transformation and disruptive technology on their daily routine, with the latter being a process that begins in a small, inconspicuous niche of an industry (Christensen et al., 2015). Based on a new technology or business model, products or services are developed to initially appeal to only a small segment of customers. According to Christensen and Bower (1995), this offering gains momentum, then becomes a dominant market factor, displacing many established companies and their products. In this context, Gomber, Koch, and Siering (2017) considered it crucial for decision-makers to have a clear perception of market developments and an understanding of possible barriers to the implementation of digitalization, as well as a general understanding of technology since, according to Kelchevskaya et al. (2019), experts' digital knowledge has a constant and significant effect on the degree of digitalization.

Digitalization and digital transformation in banking

A detailed examination of the influence of digitalization on banking revealed that it affects customers, banks, and external providers. Alt (2016) defined *consolidation*, *decentralization*, *internationalization*, *regulations*, *specialization*, and *customer orientation*, while Dorschel (2018), Manz (2018), and Strietzel et al. (2018) defined *process optimization* and *general acceleration*. These drivers outline a dynamic market environment for banks, which have long been able to operate in a comparatively calm and regulatory-protected environment. Although digitalization is understood as the key driver, it influences other drivers, such as the consolidation and internationalization of existing businesses, standardization of processes, or customer orientation and, therefore, has a broader effect (Alt et al., 2018).

This results in adjustments of existing structures, affecting not only internal processes and systems but, above all, interaction with customers and service providers (Valero

et al., 2020). Internally, bank digitalization includes the application of concepts of industrialization, such as modernizing existing architectures and core banking systems, which are often implemented on older technologies (Mekinjić, 2019). In customer orientation, it targets the future design of the customer interfaces, while service provider interaction may aim at a more cost-efficient service provision in networks as well as the expansion of product offerings and market presence (Gimpel et al., 2018).

Dorfleitner et al. (2017b, 2020) confirmed the growing and prospective influence on banking of new digital business models in the finance industry. Moreover, Fernández-Portillo et al. (2019) analyzed the impact of digitalization on business and innovation performance. Siedler et al. (2021) concluded that a company's level of digitalization is directly related to its performance and that it is necessary to include this factor in its performance model.

Based on the concept of entrepreneurial orientation, Niemand et al. (2021) investigated how banks can use tactics and strategies to achieve superior performance in the age of digitalization. They used a single-item construct to measure a bank's digitalization level. The results indicated that a bank's level of digitalization does not affect its profitability to achieve superior performance. In addition, banks can still succeed even if they lag behind their direct competitors in transitioning to digital services and online banking.

Thordesen et al. (2020) showed that the understanding of digital is not widespread, and most identified measurement models do not meet scientific evaluation criteria. However, Groberg et al. (2016) thematized digitalization from a scale development perspective and analyzed its effects on the performance of new products and services, taking into account aspects of *analytics, value-added, marketing and sales, products, services, and processes*. In this context, they developed a scale called "Degree of Digitalization" (DoD).

Digital innovation and financial technology

Innovations in the digital and financial context are characterized by multiple influencing factors (Agyei-Boapeah et al., 2022; Beck et al., 2016). Two main theories explain innovative development and similarly apply to banking and FinTech: Schumpeter's *theory of creative destruction* (Schumpeter, 1943) and Christensen's *theory of disruptive technology* (Julapa & Kose, 2018).

In general, the term "FinTech" is the abbreviation for "financial technology," which can be used to describe modern digital financial services (Paulet & Mavoori, 2019; Schueffel, 2016). It represents digitalization and is used for companies that use and apply new technology to their work (Dorfleitner et al., 2017a). However, it can also be used to refer to the technology itself. In this case, the contextual meaning is decisive. Dorfleitner and Hornuf (2016,

p. 4) referred to Kawai (2016, p. 1), who described FinTech as "technologically enabled financial innovation. It is giving rise to new business models, applications, processes and products. This could have a material effect on financial markets and institutions and the provision of financial services."

Barroso and Laborda (2022), Boot et al. (2021), and Nugroho and Hamsal (2021) described FinTech as the central concept of structurally significant change and digitalization in the financial services industry. Findings by Omarini (2017) and Thakor (2020) revealed the diversity of FinTech business models. FinTech uses digital infrastructures to establish novel offers and transaction methods in what is traditionally seen as the remit of the banking business (e.g., investment strategies, and lending and payment transactions; B. Li & Xu, 2021; Tseng & Guo, 2022).

The characteristics of this digitalization process include simplified access to bank products and services for end users, via the internet or mobile apps; an increase in processing speed, including automation processes; cost reductions; strong service orientation and convenience; transparency; and the use of network effects (Statista, 2021a). However, according to Kroener (2017), digitalization is not automatically considered as FinTech. Rather, he considers it to be (1) new interfaces to the customer, (2) new marketplaces, (3) new processes, and (4) added value through new behavioral possibilities. Feuerriegel and Neumann (2017, p. 77) stated that FinTech could be understood as the input of technology; an organization; and the money flow that leads to new services, products, processes, or new business models—FinTechs are defined as creators, changers, or improvers that disrupt and thereby create competition through the use of information technology (IT) in the financial sector.

The financial technology market and its characteristics

The FinTech market can be described from a quantitative perspective. National markets differ considerably in terms of size and market participants. For example, the German banking sector, as one of the most developed markets in the world, is one of the largest FinTech markets in the world, next to the United States (Cambridge Centre for Alternative Finance, 2016, p. 56; Ernst & Young, 2016; KPMG, 2020; Statista, 2021a). In particular, Dorfleitner et al. (2020) identified 694 active FinTechs in Germany as of 2020. However, significant and transparent data on the market from public authorities remain lacking. Comprehensive data are currently only available from Statista's annual *Digital Market Outlook*, which describes developments in the global FinTech market (Statista, 2021b, 2021c). The data show that the financial technology market continues to expand. Thus, it can be seen as a long-term competitor to traditional banking.

In the global FinTech market, digital payments represent the largest segment, with an estimated total transaction value of US\$8,502 billion as of 2022 (Statista, 2021c). By 2026, this sector is projected to have a user base of approximately 5,197 million people. In alternative finance, the average transaction value per user is expected to be US\$30.13,000 in 2022 (Statista, 2021c). Furthermore, according to forecasts, neo-banking (e.g., Revolut, Chime, Nubank, N26 and Monzo, which are hidden champions in the market; Benz et al., 2021) is projected to grow by 40.3% in 2023, and the total transaction volume of US\$8.61 billion is expected to be reached by 2026, which corresponds to the expected annual growth of 22.36% (CAGR) in transaction volume (Statista, 2022).

Some banks have already recognized this development and the need for change (Demertzis et al., 2018; Murinde et al., 2022). In response, they established their own units and companies via accelerators and/or incubators (S. Cohen, 2014) or attempted to massively invest in or collaborate with FinTechs to secure a first-mover advantage (Bellardini et al., 2022; Hornuf et al., 2021; Pauwels et al., 2015; Riikkinen & Pihlajamaa, 2022).

In summary, the entire financial market is transforming, in order to remain competitive in the long term (Elia et al., 2023; Japparova & Rupeika-Apoga, 2017). Various ratings and rankings assess the state of digitalization concerning FinTech by country, of which Germany is one of the leading countries (Lavrinenko et al., 2023). The German banking system is characterized by its banking diversity and, at the same time, by strict supervision and regulation by the state financial supervisory authorities. At the same time, it represents one of the world's most developed and solid systems (International Monetary Fund, 2022). Innovative financial products receive significant attention from German banks (PwC, 2020), providing a favorable market environment for digitalization studies.

Hypothesis development

Little research on management gaps has been identified in banks' digital adaptation to the aforementioned changing competitive situation. Diener and Špaček (2021) conducted a qualitative study based on contextual interviews with banking professionals to identify barriers to digitalization. Their results yielded a potential item set highlighting eight categories relevant to cope with digital transformation in banking: *strategy and management, customers, employees, technology and regulation, knowledge and product, market, participation, and benefits*. Their findings suggested that the respective main categorizations have a great diversity of interpretations and a high level of detail. On this basis, an exploratory factor analysis (EFA) was conducted, which facilitated the development of the hypotheses for this study, taking into account previous studies (Fabrigar et al., 1999; Hallen et al., 2020; Shrestha, 2021; Vissa, 2012).

Based on the factor analysis results, the hypotheses are assumed to affect the DoD of banks, that is, the four independent variables having an effect on the dependent variable DoD. Hence, the hypotheses were based on the respective variable explanations and theoretical assumptions, which are decisive for the direction of the effect of the independent variable. Furthermore, these hypotheses are supported by scientific evidence that is transferable to the present study. The following hypotheses (H) were examined:

H1: Personal involvement in digital development has a positive effect on the degree of digitalization of banks.

The existing literature supports the idea that customer and employee personal involvement in digital development positively affects DoD at banks. Scholars have highlighted that personal involvement mainly exerts an effect through proactive customer orientation and developing employee competence in digital transformation (Blocker et al., 2011; Cetindamar Kozanoglu & Abedin, 2021; von Leipzig et al., 2017; Warner & Wäger, 2019):

H2: Strategic corporate management has a positive effect on the degree of digitalization of banks.

H2 is substantiated by studies supporting the assumption that strategic management and leadership are essential pillars of the corporate change and development processes (Belias & Koustelios, 2014; Hosmer, 1982; Johnson, 1992; Nag et al., 2007). In this regard, strategic management and related processes are to be understood as the set of commitments, decisions, and actions required to achieve strategic competitiveness and superior returns (Hitt et al., 2019, p. 6). This in turn is closely related to leadership, described as a process whereby one individual influences a group of people to achieve a common goal (Northouse, 2021, p. 5):

H3: Complex technology and increased regulation have a negative effect on the DoD of banks.

The negative effects of complex technology and increased regulation (e.g., Basel III/IV, Banking Act) have been identified by several studies that highlighted the technical obstacles of infrastructure, digital security, and increasing regulation (Anagnostopoulos, 2018; Haag et al., 2020; Sardana & Singhania, 2018; Sironi, 2018):

H4: Employee circumstances¹ have a negative effect on the DoD of banks.

Studies have confirmed employee resistance to organizational change, which supports the hypothesized negative

effect of employee circumstances on DoD (Furst & Cable, 2008; Stanley et al., 2005; van Dijk & van Dick, 2009; Zwick, 2002).

Methodology

Research design and scales used to measure barriers and digitalization

This study considers the findings of Groberg et al. (2016), who thematized digitalization from a scale development point of view and analyzed its effects on the performance of new products and services. They developed a scale called *Degree of Digitalization* (DoD) and examined the following variables in detail: *digital products and services*, *digital operations*, *digital analytics*, *digital marketing and sales*, and *digital ecosystems*.

This validated scale could be used in its entirety for future investigations. However, this study aimed to examine decision-makers' perceptions of digitalization and quantitatively assess barriers to digitalization. Thus, based on the literature and contextual interviews, 53 items were identified as possible barriers to the implementation of digitalization (Diener & Špaček, 2021). They formed the basis for the EFA, *confirmatory factor analysis* (CFA), and exogenous measurements in the *structural equation model* (SEM) in order to conduct hypothesis testing. These methods are in line with methodological standards.

Since no appropriate scale for measuring *management perception of digitalization (in banking)* was available, a scale was developed in accordance with research by Podsakoff et al. (2012). Groberg et al.'s (2016) findings seemed to provide the most stable and comprehensive approach to measuring DoD. However, due to the extensive scale, it was not possible to use their scale systematically, as this could lead to a high dropout rate (Hollenberg, 2016; Porst, 2011). Thus, only the strongest items that they developed were considered. Finally, one item was added to measure decision-makers' general perceptions of digitalization within their organization. This item was recommended and validated by experts, as it has not been considered so far in the item set. However, it seemed essential for determining banks' digitalization and the scale's completeness.

Derivation and conditions of statistical methods

Factor analysis (FA) can be performed using various statistical methods and programs to analyze variable constructs. FAs can generally achieve their purposes from an exploratory or confirmatory perspective (Hair et al., 2018, p. 125).

In particular, EFA is effective in preliminary analysis when a sufficiently detailed theory is lacking about the relationship between the variables and the underlying constructs (Gerbing & Anderson, 1988). It can be used to

factorize a complete set of items and then construct scales based on the resulting factor loadings. EFA provides the most interpretable results when reducing large amounts of data (Loker & Perdue, 1992). Because we want to measure different constructs of digitalization and its associated barriers, EFA is an appropriate technique for explaining correlations between a number of observed variables and a few factors (Churchill, 1979; DeVellis, 2016). It aims to trace many correlated, manifest variables to a small set of latent variables (factors) that clarify variance in the initial variables as far as possible.

Each manifest variable is a linear combination of factors, whereby a variable's weight stands for its so-called factor loading (Bühner, 2010, p. 181). This assumes that the value of a variable can be additively broken down into a weighted sum of factors (Klopp, 2010). Since the present study aims to trace correlations between the items and their latent variables, *principle axis factor analysis* (PAF) was applied (Mabel & Olayemi, 2020; Russell, 2002).

Moreover, rotation was used to optimize the interpretability of the variables through high loadings on one factor and low loadings on another (Costello & Osborne, 2005). Due to the unknown nature of the data, the lack of theoretical assumptions, and the aim of achieving interpretability, several rotations were applied (Hair et al., 2018, p. 151). EFA assumes primary framework conditions essential for calculating reliable results (Weiber & Mühlhaus, 2014, p. 148). The *Kaiser–Meyer–Olkin criterion* (KMO) and *Bartlett's test* were used to assess the sampling adequacy of the data. Both provide information about the coherence of the variables and their overall fit. Kaiser and Rice (1974) stated that the value for *sampling adequacy* (measurement systems analysis (MSA)) measures should not be under .60. Other sources suggested a threshold of .50 (Cerny & Kaiser, 1977). Hair et al. (2018, pp. 152–153) mentioned that "factor loadings of ± 0.30 to ± 0.40 are minimally acceptable [...] to be considered significant," while Costello and Osborne (2005) stated that only loadings greater than 0.30 should be considered.

Finally, Yong and Pearce (2013) noted that psychological significance and interpretation play an important role. In addition, Cronbach's alpha was calculated to assess reliability. The given thresholds range from .70 to .80. Values close to .60 can also be acceptable in exploratory research as long as the interpretability of a scale is explained (Döring & Bortz, 2016; Nunnally & Bernstein, 1994; Schmitt, 1996).

CFA is the method for evaluating construct validity (Prudon, 2015). In many scenarios, the variables of interest are so-called hypothetical constructs (Marsh et al., 2013). These are not directly observable and are operationalized through measurement models. Such a factor model is a statistical statement about the relationships between the variables, that is, the barriers to digitalization (Suhr,

2006). CFA assumes that the latent variables can be operationalized through so-called reflective measurement models (Hair et al., 2018, p. 730).

SEM is based on CFA. It is a multivariate statistical framework that models complex relationships between directly and indirectly observed variables (Kline, 2015, pp. 9–10). Jost (2014, p. 5) defined SEM as a method that explains the relationship between multiple variables in a hypothetical construct. The purpose of SEM “[. . .] is to account for variation and covariation of the measured variables” (Suhr, 2008, p. 1). The effect and strength of previously derived latent variables (i.e., actual barriers to digitalization) were tested. SEM focuses on two issues: “(1) overall and relative model fit as a measure of acceptance of the proposed theory and (2) structural parameter estimates representing direct and indirect relationships with on-headed arrows within a path diagram” (Hair et al., 2018, p. 702).

Once the best model is selected, it is visualized as a path diagram that includes indicators for latent variables and causal pathways (Stein et al., 2012, p. 510). The path diagram for the SEM represents functional relationships between multiple regression analyses, which in turn represents a special case of SEM (Stein et al., 2012). One must differentiate between the path analysis (PA) and the CFA, which are both parts of the SEM.

The PA of the model is the presentation of *p*-values for each path coefficient and some assessment of the final model’s goodness-of-fit (GOF; Stein et al., 2012, p. 510). Deng et al. (2018) highlighted the issue of sample size (*N*) and its effects on model reliability. In addition, Weiber and Mühlhaus (2014, p. 148) summarized the underlying conditions fulfilled in this study.

The overall model fit represents “the degree to which a pattern of fixed and free parameters specified in the model, consistent with the pattern of variances and covariances from a set of observed data” (Suhr, 2008, p. 3). The sample size impacts fit indices and many relative and non-centrality indices depend on it. Thus, a larger sample size is considered as a better fit.

It is recommended to use several measures in parallel to achieve more reliable results. There is still a need to explain whether other options exist that could improve the model and why they were adopted or not (Xia & Yang, 2018). In line with a Simms et al. (2019) recommendation, a six-point Likert-type scale was used for all measurements.

Sample selection and data collection procedures

Data collection

The German banking market is primarily dominated by cooperative and savings banks, with 62%² of the total

banking market in terms of employees and the largest share of regional and supra-regional branch coverage in retail banking (AGVBanken, 2022). Both types of banks are ranked equally as good service providers, offering almost identical product ranges to their customers (Diener & Špaček, 2021), which is why they are in focus of this study. Quantitative data were collected between 15 September 2020 and 22 October 2020 via an online survey that targeted decision-makers at savings and cooperative banks. For this purpose, a web link to access the questionnaire was sent by e-mail. Since access to decision-makers is limited and challenging, a partnership was established with a polling company called QuestionPro.³ QuestionPro provided the platform and software required for the survey and independently collected data based on the survey developed for this study.

In addition, we collected 6,000 e-mail addresses of CxO⁴ employees at randomly selected German banks on the *LinkedIn* career platform. To validate the addresses and avoid returned e-mails, the QuickEmailVerification, NeverBounce, and MailTester tools were used.

Data description

Based on the available bank data, 814 cooperative and 376 savings banks (DSGV, 2021) form the total population for this quantitative study approach. Hence a total of 1,190 banks and approximately 336,300 employees, as it can be assumed that each institution has at least one decision-maker and/or expert. However, the actual population of decision-makers is much more prominent as banks are not authoritarian-led companies in which decisions are made by one person alone. From an objective point of view, the highest operational decision-making level within a bank is between 1 and 10 board members. Considering the total number of cooperative and savings banks (*N*=1,190) and a possible board size of 10 persons, it results in 11,900 persons.

According to Dillman (2011, pp. 205–210), Dillman et al. (2014, p. 80), and Salant and Dillman (1994, pp. 54–58), a population of 10,000, assuming a confidence level of 95% and an acceptable level of sampling error margin $\pm 5\%$, would result in a recommended sample size of *N*=370. In total, 1,233 recipients opened the survey link. Of this number, 760 began to fill out the survey; this corresponded to a rate of 12.7%. Responses for 724 out of 760 surveys were directly collected via e-mail, while 36 surveys were collected by QuestionPro via lead panel. Subsequently, 167 out of 760 surveys were excluded due to incompleteness, as only completed surveys could be considered for the analysis. This corresponded to an overall rate of 9.9% for valid surveys.

The data were also examined for non-managerial respondents. This left 407 valid surveys (6.8%), which corresponds to an appropriate sample size, according to

Dillman et al. Of these, 175 (43%) were completed by participants from savings banks at different hierarchical levels, while 232 (57%) were completed by participants from cooperative banks (Table 1).

Furthermore, respondents were classified according to their work qualifications and date of birth. The latter enabled us to obtain an overview of the respondent age structures and confirmed that all age groups were represented. In addition, work experience was relevant to participants' perceptions of entrepreneurial issues (Figure 1). The inclusion of this criterion showed that there was an appropriate balance between respondent experience levels (Table 2).

Results

Pilot testing

Before conducting the main study, the survey was subjected to a 1-week pretest (Kaya, 2009). To this end, it was first tested for comprehensibility by three respondents, all chief executive officers at banks. This revealed a need for minor changes, rather than a wholesale reformulation of the survey items. Subsequently, a second pretest round was administered to a larger test group via QuestionPro ($n=131$). Due to the use of an online survey, no attention could be paid to the test conditions, as they could not be directly influenced. The results showed acceptable outcomes for loadings and correlations. The KMO (0.736) and Bartlett's test (chi-square: 3,142.139, $df: 1,378$, $sig: 0.000$) also produced acceptable and significant results. Only a few potential cross-loadings were identified. However, due to the small sample for the pretest, no adjustments were made.

Table 1. Valid test subjects.

Management	Savings banks		Cooperative banks		Σ
	Male	Female	Male	Female	
Top	35	7	80	3	125
Middle	95	9	124	13	241
First-line	25	4	11	1	41
Σ	155	20	215	17	407

EFA

Subsequently, an EFA was performed in SPSS with $n=407$. The data showed significant suitability, which was confirmed by the KMO (0.842) and Bartlett's test (chi-square: 6,098.557, $df: 1,378$, $sig: 0.000$). MSA values were above the threshold of 0.50. The communalities⁵ failed to show any excessive abnormalities, although it should be noted that some variables yielded a low value, which was also due to a large number of variables. However, since the results showed that the communalities were at the threshold, these variables remained included in the study.

The results of the first-order rotated factor matrix identified a 15-factor solution. Varimax was applied, as this is a proven method, and the factors were assumed to be uncorrelated. Oblimin was also considered in order to meet scientific criteria. Since scales should ideally include at least three items (Hair et al., 2018, p. 666), scales with less than two items were excluded from the analysis. Items with cross-loadings⁶ were also eliminated, according to Hair et al. (2018, pp. 155–156).⁷

The first re-specification served as a basis for the further derivation of the items. The second-order calculations were performed under the same conditions as the first. Again, cross-loadings were identified, which proved not to be problematic. In the revision of the EFA results, a more precise measurement approach was followed by setting a loading threshold of 0.40.⁸ Since the variables *PC* and *PE* were assigned to the same factor and showed high loadings, deleting a two-item scale was inappropriate. Moreover, the interpretation and assignment of the variable construct was given in terms of content. As a result, a

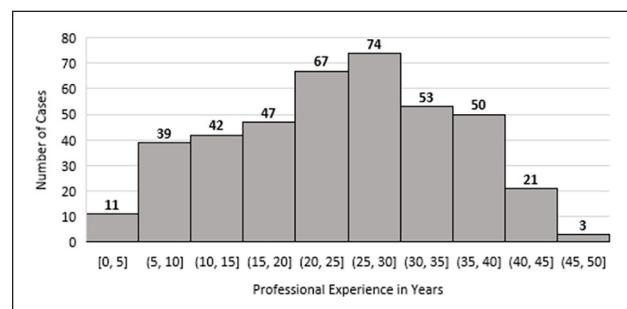


Figure 1. Professional experience of valid test subjects.

Table 2. Highest qualification of valid test subjects.

Management	Professional training		Undergraduate studies		Postgraduate studies		Others		Σ
	Male	Female	Male	Female	Male	Female	Male	Female	
Top	26	–	36	9	43	1	10	–	125
Middle	82	10	70	11	59	–	8	1	241
First-line	17	2	11	3	7	–	1	–	41
Σ	125	12	117	23	109	1	19	1	407

total of six factors were obtained, which did not show any significant cross-loadings and therefore did not require any further reduction of the variables.

These results were then re-examined using the oblimin rotation to verify the consistency of the rotated variables and their factor allocation (Bühner, 2010, pp. 228–234). In the process, both the structure matrix⁹ and the pattern matrix¹⁰ must be holistically considered. The re-examination results showed almost the same factor allocations as for the Varimax rotation, further supporting the previous findings.

However, some variables did not allow for clear interpretations, making it impossible to logically develop possible sets of variables for factors. Since these variables could not be interpreted, they had to be excluded from further analyses. The Varimax results were concretized, and found that they were no longer sufficiently robust overall. Consequently, there were four main factors that could be interpreted (Table 3).

The valid sets of items led to the following factors, which were used to answer RQ1.¹¹

Factor 1: personal involvement in digital development (PI). This factor highlights the involvement of employees and customers in digital development as an essential element. It is understood that employees are actively included, and customers are actively involved in digital development while at the same time helping to shape it.

Factor 2: strategic corporate management (SCM). Strategic corporate management seems to be an important factor that could be interpreted through three variables. It was found that banks are expected to restructure themselves in the future and rethink existing approaches. Furthermore, banks increasingly respond to the market and competition by attempting to keep up with emerging developments.

Factor 3: technology and regulation (TR). Regulatory, legal, and organizational requirements lead to implementation problems. As the complexity of digital transformation increases, organizational complexity is seen as an obstacle to digitalization. Furthermore, the technical efforts required to pursue new and further digital development are very high (e.g., for processes and products), which results in a dependence on central services and technologies. In addition, public infrastructure inhibits digitalization, as it often does not meet the requirements of comprehensive bank digitalization, and structural framework conditions (e.g., fast internet connections) are not always in place.

Factor 4: employee (E). This factor refers to employee-related implementation barriers. In particular, it concerns a lack of acceptance and the rejection of change among employees.

Another problem is the availability of affordable employees with a positive attitude toward digitalization. Other key factors influencing employee receptiveness to digitalization include their age and qualifications.

As part of the internal consistency test, Cronbach's alpha was determined for the four valid factors (independent variables) and the DoD of banks (dependent variable). DoD encompasses items focusing on aspects of digitalization in banking, that is, *analytics, value-added, marketing and sales, products, services, and processes*. Furthermore, the item *Digitalisation_In_Total* supplements the DoD scale due to an overarching view and the possibility of interpretation (Table 4).

The results show that the derived factor sets have a high internal consistency ($>.70$) and thus align with the thresholds proposed by Döring and Bortz (2016), Churchill (1979, p. 68), Hair et al. (2018, p. 163), Nunnally and Bernstein (1994, p. 252), and Schmitt (1996). Only SCM had a Cronbach's alpha close to .60. However, due to the exploratory character of the study, it was still considered as a valid factor in further analyses. Further optimization of the scales through the deletion of items did not lead to any improvements in the scales.

Development of structural equation model

The results of the EFA led to a model structure which allowed the hypotheses to be tested using AMOS. The SEM was based on the hypothesis construct (see section “Hypothesis development”). Thus, it helped to interpret statistical dependencies causally and to examine data-fit in the model.

First, the model fit results indicated good to very good model parameters, with (A)GFI and CFI having further potential for improvement (Hooper et al., 2008; Xia & Yang, 2018). AMOS calculates covariance modification indices. By correlating the error variances, but only the corresponding correlation within an item set, independence and, thus, simultaneous improvement of the model fit could be achieved (Hair et al., 2018, p. 665) (Table 5).

This adjustment ultimately improved the model, which led to an overall excellent model fit. CFI and AGFI could be regarded as excellent. Since GFI was specified near the threshold and was interpreted as very good, no further adjustments to the model were required (Table 6).

On this basis, the research model shown in Figure 2 was developed, which took hypothesis testing into account.

Hypothesis testing

Table 7 shows the latent predictor variables that were used to determine the predefined dependent variable (DoD) and explains causal relationships. In accordance with the developed hypotheses (H1–H4), each predictor was analyzed and interpreted in more detail.

Table 3. Factor analysis matrix.

Construct	Item	Statement forming the question	Factor ^a		Pattern ^b		Structure ^b		Descriptive statistics		
			Loading		M	SE	SD	Variance			
Technology and regulation	TRB // Technology_Regulatory_BARRIERS	Regulatory requirements lead to internal/external obstacles that slow down digitalization.	0.635	0.649	0.661	4.70	0.051	1.038	1.077		
	TRID // Technology_Regulatory_Implementation_Difficulties	Legal and organizational requirements lead to implementation problems and slow down/hamper digitalization.	0.583	0.561	0.638	4.45	0.038	0.767	0.588		
	TRDP // Technology_Regulatory_Data_Protection	Banks are (subjectively) more closely monitored and are more in the public eye than FinTechs. This slows down digitalization.	0.512	0.552	0.512	5.06	0.047	0.944	0.891		
	TRE // Technology_Regulatory_Effort	The technical effort for digital new/further development is very high (e.g., for processes and products).	0.491	0.454	0.548	4.71	0.042	0.846	0.716		
	SMSV // Strategy_Management_Structure_and_Variety_of_Interestes	Organizational complexity increases the complexity of digitalization.	0.500	0.439	0.576	4.70	0.048	0.969	0.938		
	SMAS // Strategy_Management_Association_Structure	Association structures mean dependence on central services and technologies: freedom of choice is restricted. Individuality is lost.	0.433	0.426	0.468	4.58	0.055	1.113	1.239		
	TRPI // Technology_Regulatory_Public_Infrastructure	The public infrastructure does not meet the requirements for comprehensive digitalization.	0.392	0.372	0.437	4.21	0.051	1.037	1.075		
	SMHes // Strategy_Management_Restructuring	Banks will increasingly restructure and rethink approaches in the future.	0.553	0.564	0.599	4.95	0.038	0.766	0.586		
Strategic corporate management	SMRea // Strategy_Management_Reactions_S // Strategy	Banks react to market and competitive situations: They try to keep pace with developments. The future will be strongly influenced by digital topics: digitalization is an essential part of the banking strategy.	0.519	0.510	0.566	5.17	0.039	0.794	0.630		
	PE // Participation_Employees	Employees are actively involved in digital development.	0.774	0.774	0.789	4.14	0.052	1.058	1.119		
Personal involvement	PC // Participation_Customers	Customers are involved in the digital development to actively shape it.	0.713	0.725	0.723	3.39	0.054	1.082	1.170		
Employee	EFI // Employee_Flexibility	Employees often reach their limits digitally. They must become more flexible.	0.664	-0.683	-0.683	4.29	0.045	0.912	0.831		
	EAc // Employee_Acceptance	Employees initially do not accept change and reject new things.	0.649	-0.670	-0.665	3.52	0.048	0.967	0.935		
	EQ // Employee_Qualification	The skills of the workforce are not sufficient to cope with complex digital issues.	0.629	-0.626	-0.657	3.83	0.055	1.111	1.235		
	ET // Employee_Transparency	Digitalization leads to increased employee and process transparency, which employees fear.	0.558	-0.546	-0.594	3.78	0.053	1.079	1.164		
	EAS // Employee_Age_Structure	Young employees accelerate, older employees slow down digitalization.	0.498	-0.494	-0.523	3.81	0.049	0.987	0.975		
	EAy // Employee_Availability	There is a lack of skilled employees at reasonable salaries to fill IT positions and enable digital transformation.	0.435	-0.404	-0.477	4.05	0.048	0.974	0.948		
Degree of digitalization	DA // Digitalisation_Analytics	Compared with our competitors, our company performs much better in the following areas:					3.11	0.052	1.040	1.081	
		... digital analytics (e.g., solving complex problems based on large amounts of data, automation of data analysis)									
	DVA // Digitalisation_Value_Added	... value creation through digital exchange with external partners (e.g., use of the IT skills of the partners, exchange of expertise for joint product creation)					3.36	0.053	1.060	1.124	
	DMS // Digitalisation_Marketing_Sales	... digital marketing and sales (e.g., application of customer-specific marketing initiatives, digital sales promotion and practices)					3.51	0.054	1.089	1.186	
	DPS // Digitalisation_Products_Services	... digital products and services (e.g., reinventing business models/products that exploit digital opportunities)					3.53	0.052	1.045	1.092	
	DP // Digitalisation_Processes	... digital processes (e.g., in the value chain)					3.44	0.048	0.975	0.951	
	DT // Digitalisation_In_Total ^c	... compared with our competitors, our company performs much better in the following areas: digitalization as a whole.					3.47	0.049	0.994	0.988	

IT: information technology.

^aExtraction method: principal axis factoring. Rotation method: varimax with Kaiser normalization (3rd order).^bExtraction method: principal axis factoring. Rotation method: oblimin with Kaiser Normalization (1st order).^cConstructed for reasons of completeness.

H1: Employees' and customers' active involvement in shaping digital development has a positive effect on digitalization in banks. It seems essential for decision-makers to actively involve employees in digitalization issues and encourage them to develop their own ideas to further develop approaches to digitalization. The same can be observed at the level of customers, who should be seen as partners. Their active involvement in the ongoing digital transformation process suggests that early integration enables a more goal-oriented consideration of needs, ultimately facilitating and accelerating actual transformation. Therefore, the application of digital solutions and the acceptance of both employees and customers

are perceived to be essential. It can be concluded that the study's results support H1. In other words, personal involvement (PI) in digital development has a positive effect on the DoD of banks, with a standardized beta of .475 at a high level of significance ($p \leq .001$). Thus, H1 is supported.

H2: Strategic corporate management (SCM) consists of three items that focus on a bank's digital strategic competence and strategic integration. Banks should increasingly focus on possibly restructuring and rethinking their approaches in the future, including initiating digitalization. The aspects of restructuring and rethinking were considered as an essential part of a strategic barrier that influences a bank's digitalization. However, H2 cannot be confirmed from a statistical standpoint, as statistical significance was not reached ($p > .10$). Similarly, the standardized beta of .094 is very low, which means that SCM has a very small effect on the DoD. These findings do not provide significant evidence that banks are expected to restructure and rethink existing approaches in the future from a strategic perspective. Furthermore, no statement can be made about whether banks are increasingly responding to the market and competition through strategic corporate management. Therefore, H2 is not supported.

Table 4. Cronbach's alpha.

Factor	Cronbach's alpha	No. of items
Degree of digitalization (DoD)	.887	6
Personal Involvement (PI)	.724	2
Strategic corporate management (SCM)	.573	3
Technology and regulation (TR)	.745	7
Employee (E)	.768	6

N=407.

Table 5. Modification indices.

Variable	M.I.	Par change	Variable	M.I.	Par Change
e7 <-> e6	4.908	0.072	e10 <-> e13	7.649	-0.108
e8 <-> e7	5.051	-0.084	e10 <-> e17	4.553	0.070
e22 <-> Personal involvement	15.020	0.135	e10 <-> e19	7.407	-0.107
e22 <-> Employee	4.276	-0.044	e11 <-> e23	7.718	-0.080
e24 <-> Personal involvement	5.306	-0.082	e11 <-> e17	4.126	-0.059
e24 <-> Employee	5.362	0.050	e11 <-> e20	5.744	0.060
e13 <-> Strategic corporate management	5.448	0.064	e2 <-> Personal involvement	8.258	-0.103
e13 <-> Employee	6.605	-0.071	e2 <-> Technology and regulation	7.884	-0.061
e13 <-> e7	4.248	-0.077	e2 <-> e6	6.651	-0.065
e13 <-> e22	6.594	0.073	e2 <-> e14	9.433	-0.086
e14 <-> e6	4.434	0.065	e2 <-> e1	12.284	0.057
e15 <-> e25	5.304	0.070	e3 <-> e13	4.44	-0.067
e16 <-> Personal involvement	8.885	-0.157	e4 <-> Technology and regulation	4.212	0.052
e16 <-> e22	5.317	-0.076	e4 <-> e10	4.017	0.072
e16 <-> e14	8.957	-0.123	e4 <-> e11	5.364	-0.073
e17 <-> e15	6.336	-0.086	e4 <-> e2	11.671	-0.092
e19 <-> Employee	6.876	-0.073	e4 <-> e3	9.69	0.090
e19 <-> e6	6.954	0.085	e5 <-> Personal involvement	7.376	0.114
e19 <-> e13	14.99	0.145	e5 <-> e6	23.157	0.144
e20 <-> e15	7.927	0.083	e5 <-> e24	4.367	-0.056
e21 <-> Employee	4.735	-0.059	e5 <-> e13	7.718	0.096
e21 <-> e19	6.618	0.095	e5 <-> e1	6.522	-0.050
e10 <-> e7	5.921	0.094			

M.I.: Modification indices.

N=407.

Table 6. Adjusted model fit measure.

Measure	Estimate	Threshold	Interpretation
Quality dimensions			
CMIN	345.736	—	—
DF	232	—	—
CMIN/DF	1.490	Between 1 and 3	Excellent
Chi-square (χ^2)	1.000	>0.05	Excellent
GFI	0.934	≥ 0.95	Acceptable
AGFI	0.914	≥ 0.90	Excellent
Root mean square error of approximation (RMSEA)	0.033	<0.06	Excellent
Standardized root mean square residual (SRMR)	0.054	<0.08	Excellent
Comparative fit index (CFI)	0.961	>0.95	Excellent

CMIN: Chi-square; DF: Degree of freedom; CMIN/DF: discrepancy divided by degree of freedom; GFI: Goodness-of-fit; AGFI: Adjusted Goodness-of-fit.
N = 407.

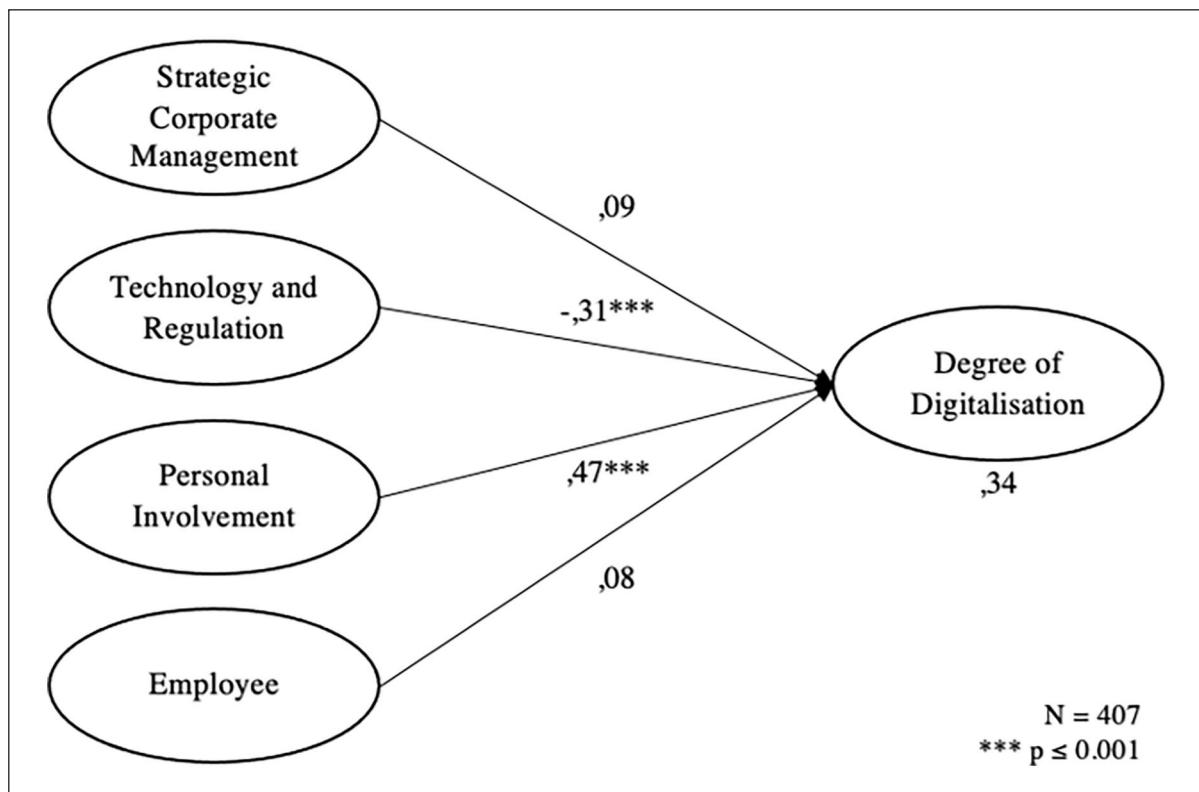


Figure 2. Estimated structural equation model (simplified).
For full model see Appendix I.

H3: Legal and organizational requirements and the assumption that these lead to implementation problems and delay or inhibit digitalization are an essential part of the latent variable technology and increased regulation. The organizational complexity of digitalization is also increasing, while regulatory requirements lead to internal and external obstacles that delay this process. In addition, it is important to mention the technical effort as a part of this barrier, as the effort is considered to be very high for new or continued digital developments

and to inhibit digitalization in banks. However, the dependence on existing bank association structures, with the central services and technologies used by them, leads to limited freedom of decision. In addition, public infrastructure does not meet the necessary requirements for large-scale digitalization and will no longer be able to meet the ever-increasing demands of a digital future in the short term. Therefore, the results of the present study support the assumptions made in H3. Complex technology and increased regulation (TR) have a negative

Table 7. Model estimates.

	Hypothesis	Predictor	Outcome	(Unstandardized)			(standardized) SMC ^{a,b}
				Estimate	S.E.	C.R.	
Latent construct	H1	Personal involvement	Degree of digitalization	0.341	0.057	6.026	0.475
	H2	Strategic corporate management		0.129	0.104	1.238	0.094
	H3	Technology and Regulation		-0.348	0.104	-3.341	-0.314
	H4	Employee		0.089	0.081	1.110	0.080
Indicator construct		Degree of digitalization	Digitalisation_In_Total	1.266	0.086	14.726	0.829
			Digitalisation_Products_Services	1.092	0.082	13.255	0.559
			Digitalisation_Processes	0.999	0.084	11.894	0.537
			Digitalisation_Marketing_Sales	1.111	0.086	12.913	0.532
			Digitalisation_Analytics	1.003	0.076	13.201	0.476
			Digitalisation_Value_Added	—			0.456
		Personal involvement	Participation_Employees	0.654	0.087	7.524	0.675
			Participation_Customers	—			0.616
		Strategic corporate management	Strategy_Management_Restructuring	—			0.380
			Strategy	0.832	0.138	6.029	0.548
			Strategy_Management_Reactions	0.584	0.105	5.568	0.433
		Technology and regulation	Technology_Regulatory_Implementation_Difficulties	0.755	0.078	9.642	0.637
			Strategy_Management_Structure_and_Variety_of_Interests	0.942	0.098	9.636	0.629
			Technology_Regulatory_Barriers	—			0.395
			Strategy_Management_Association_Structure	0.847	0.106	8.004	0.623
			Technology_Regulatory_Public_Infrastructure	0.686	0.101	6.778	0.492
			Technology_Regulatory_Effort	0.780	0.085	9.215	0.428
			Technology_Regulatory_Data_Protection	0.598	0.082	7.319	0.596
		Employee	Employee_Flexibility	—			0.168
			Employee_Acceptance	0.979	0.093	10.539	0.645
			Employee_Qualification	1.110	0.108	10.306	0.636
			Employee_Transparency	0.991	0.102	9.743	0.584
			Employee_Availability	0.766	0.090	8.516	0.500
			Employee_Age_Structure	0.788	0.094	8.424	0.258

^aReferring to the outcome variable.^bSquared multiple correlations.

effect on the DoD of banks, with a standardized beta of $-.314$ and a high significance level ($p \leq .001$). Therefore, H3 is supported.

H4: The independent variable in H4 refers to employee-related implementation barriers. An important aspect and an influencing variable in the context of barrier identification is technical understanding and issues of excessive demands, as the results show a great influence on the barrier. It is also evident that digitalization has reached a saturation point and employees are probably reaching their limit in terms of digital understanding and adaptation. However, the acceptance of innovation and change is also an important component, since it has been shown that employees do not accept (or have problems of accepting) digital solutions at the beginning of a change and thus often reject it. Ultimately, this leads to complete rejection. Employees must be involved in the change process and learn to accept and grapple with digitalization and its associated innovations. The results also show that employee qualifications seem to be an important factor. The absence of qualifications is problematic and can ultimately negatively affect the implementation of digital topics and general digital change at a bank. Therefore, employees' overall, particularly technological qualifications, appear to be increasingly important for the future. Another factor seems to be age. Notably, digitalization is promoted by younger generations of employees. The availability of well-trained IT specialists also plays an important role in bank digitalization. Nevertheless, results show that significance was not reached for H4 ($p > .10$). The standardized beta of $.080$ is also considered very low. Thus, H4 is not supported.

Quantitative results of the structural equation model

The results of the SEM correspond to RQ2.¹² From a large initial number of 63 items, four content-consistent item groups were derived: PI, SCM, TR, and E. Their influence on DoD at banks was quantitatively tested within the framework of the SEM. The results revealed that two out of four hypotheses could be confirmed: H1 (Personal Involvement → Degree of Digitalization) and H3 (Technology and Regulation → Degree of Digitalization). H2 (Strategic Corporate Management → Degree of Digitalization) and H4 (Employee → Degree of Digitalization) were rejected.

From a statistical perspective, it became apparent that the qualitative assumptions and literature findings did not fully correspond to what decision-makers ultimately perceived as influencing factors in implementing barriers to banking digitalization. In particular, the fact that TR had a negative effect on DoD suggests that there is potential for improvement in this regard. Digitalization at banks can be supported through appropriate adjustments; the current level of adoption plays an important role, as it has

a positive and direct effect on the intention to adopt further digitalization in banks (Brand & Huizingh, 2008).

Structures must be rethought to effectively address obstacles to digital change. In particular, stronger internal and increasingly open-source technology development and the decentralized development of applications should be recommended, as these can be advantageous to both individual stakeholders and the bank's further development. The results revealed that PI positively affects DoD at banks, which highlights the value of promoting further integration measures. It seems important to equally integrate and consider employees and customers. On one hand, employees should be able to accept and apply digital products and services; on the other hand, customers should be informed about applications and how to apply them.

In summary, the study provides quantitative methodological approaches for further analyses in the context of digitalization and research on decision-makers in banking. Moreover, it provides a scientific basis for future quantitative analyses in this field.

Discussion and implications of findings

Practical perspectives

In this study, implementation barriers to digitalization were analyzed from the perspective of decision-makers. As a result, practical perceptions of digitalization in banking were transferred from practice to science and examined in greater detail using triangulation (Flick, 2020; Wang & Duffy, 2009).

Deeper insights into barriers could lead to measures that either prevent the emergence of a particular barrier or mitigate its impact. By being aware of the potential obstacles, decision-makers can intervene preventively in the digitalization process and keep barriers under control. The findings from this study could be incorporated into risk factors and thus become a topic in enterprise risk management. Consequently, barriers must be analyzed concerning the severity of impact and probability of occurrence.

The finding that existing IT structures and approaches hinder the development of digitalization due to their high degree of complexity and even negatively influence a bank's DoD illustrates the importance of this study in research on digital bank development. The results indicate a stronger focus on developing methods and technologies (e.g., open-source development) that have rarely been used so far but are common in other sectors and industries.

Due to the complexity of the innovation ecosystem, decision-makers should resort to the decentralization of IT systems, which could simplify processes and facilitate digitalization. Aspects of regional banking services require a better balance between supraregional and regional products and services that would better accommodate customers' needs. In addition, the study empirically supported the assumption that

customer and employee involvement are essential components of digital transformation.

Regarding H2 and H4, conditions related to strategic corporate management and employees were not found to be significant. Therefore, no conclusions about their influence on DoD and effect size could be drawn. It does not mean that the role of these factors is not significant at all, but they might need further verification and exploration in larger-sized and longitudinal ongoing studies in future. Simply said, our data do not find sufficient empirical support, and we may only speculate what could be the possible reasons. One possible explanation for the non-support of H2 could be found in the delay of the strategic period, while IT management prefers agile approaches to the usual strategic approach (following different waterfall models). H4, on the contrary, could be due to the specificities of banking or IT jobs, which are considered very prestigious, and some job-related “circumstances” might not be as influential. These aspects require further investigation since both seem intuitively important for bank digitalization.

Theoretical perspectives

An exploratory triangulation approach was used in this study, which led to the development of a questionnaire on the topic of digitalization and barriers to its implementation in banking. Several item sets were developed using EFA, forming interpretive scales with high internal consistency for factors that influence DoD banks. In particular, the structure of an existing research scale (DoD: 46-item scale; Groberg et al., 2016) was optimized to enable measurement with only six items.

In addition, the first structural equation model was constructed in this regard. It led to some ambiguous notions of digitalization in banking and confirmed, among other things, PI's positive effect on banks' DoD (Blocker et al., 2011; Cetindamar Kozanoglu & Abedin, 2021; von Leipzig et al., 2017; Warner & Wäger, 2019). In addition, the findings of Anagnostopoulos (2018), Sardana and Singhania (2018), and Sironi (2018) were supported, which highlights that complex technology and increased regulation have a negative effect on DoD.

In general, the model revealed the influence of the four independent factors and provided a clear and persuasive set of dependencies among variables and factors, which enriched the findings of Diener and Špaček (2021) and created comprehensive scales for the first time. Notably, the representation of technology and regulation in a single variable highlights their close relationship and could be generally referred to as “increasing complexity” in the future. Furthermore, the model illustrates the directions and intensity of interdependencies of variables. This provides further support for effective research on digital transformation. Therefore, the findings provide a foundation

for studies in the banking sector and call for using the tested measures and obtained results in future research.

Limitations and further research

Some limitations in this study derive from the constraints of the research methods used. For instance, instead of a postulated theory-based approach, as in the present study, deductive category building might be the better approach to avoid errors in category formation and subsequent research steps. Furthermore, the Diener and Špaček (2021) paraphrasing and summarizing approach must be critically viewed. This small-scale approach, inspired by the psychology of word processing, may lead to the formation of categories that have little or nothing to do with each other and do not correspond to the topic of interest (Mayring, 2015, pp. 88–89).

Furthermore, the available data limited the study, which posed an additional challenge due to the narrow focus on decision-makers. Other limitations include widely known weaknesses in selecting the number of factors in FA, the method of analysis, and the interpretation of factors due to subjective decisions on the part of the researcher (Bacher & Wolff, 2010, p. 360). Similarly, SEM's threshold-based optimization potential was considered based on GOF ratios, yet this is controversial among experts. Thus, it can be seen as a study limitation. However, in the SEM, these thresholds were aligned with recommendations from the literature, which mitigated the limitations of the evaluation and produced robust results.

In terms of further research, the methodology of first applying EFA to identify factors and testing the effects of factors in SEM paves the way not only for further studies in banking, but also for other segments. Due to the still very young field of barrier research, other factors that may influence the DoD of banks should be explored in more detail. Particular attention should be paid to sub-barriers whose effect may be substantial. Differentiation between individual banks and countries could provide insightful results for overcoming barriers in future.

The SEM model developed for this study can serve as a point of departure for other research that extends the exploration of this topic to other aspects (e.g., government stimuli, cross-sectoral impacts, or interference in the digitalization process by other stakeholders). Future studies could also draw attention to the impact of other, more socio-cultural management aspects, such as motivation, leadership, corporate culture, and management styles, or the feasibility of bank digitalization, which, however, have not been the focus of scientific studies thus far.

Implementing longitudinal research design, studying different types of banks in different countries with, for example, even different financial systems and ways they cope with digitalization challenges would also enrich the current state of knowledge. Notably, it would also address

some other limitations of the study, such as one country-focus, not fully representative sampling, as well as suffering to some extent from the nonresponse bias issue.

Conclusion

This article addresses the topical issue of barriers to bank digitalization, which are common across banking sectors in developed European Union (EU) countries. It tackles the severe problem of identifying barriers to digitalization, which are closely tied to the digitalization process at virtually all banks.

There is a need to develop digital business models to ensure that institutions remain competitive in a highly challenging and competitive environment. FinTechs have the potential to accelerate the delivery of financial services and personalize them to meet customers' needs. Moreover, they provide customers with multiple channels, which allow them to choose the most appropriate solutions for their situations. Ultimately, these customizable financial services are cheaper for clients.

The fact that institutions cannot keep up with this digital development and identify barriers to digitalization creates problems for the entire banking sector and the process of bank digitalization itself. The current scientific and professional literature does not fully reflect the urgency of finding a solution to this problem.

Notwithstanding ongoing efforts to identify barriers to digitalization, banks often lag in completing digitalization processes. As a result, they are at high risk of being outcompeted and disrupting their business. Therefore, this research bridges the gap between potentially unidentified barriers to digitalization and banks' actual degree of digitalization. It also identifies the most relevant barriers to digitalization that may influence the effectiveness of the digitalization process.

As a point of departure, we defined the primary goal of this article as the identification and analysis of barriers to digitalization in the context of the banking sector from the perspective of decision-makers. This goal was supported by formulating two RQs, bringing additional clarity to the analysis process. The findings obtained through EFA enabled the development of four hypotheses that were subsequently verified through the SEM approach.

Due to the broad scope of this topic, the study was limited to the German banking sector. Its orientation was driven not only by this sector's high level of maturity but also by the reasonable transferability of the results to other EU and non-EU countries.

The current study builds on previous qualitative research that revealed as many as 53 barriers to digitalization, which created a basis for subsequent quantitative analysis through EFA and the development of SEM to describe mutual dependencies among individual factors and provide the statistical relevance of these dependencies.

The primary sample collected in 2020 encompassed data from 407 German savings and cooperative banks.

These findings contribute significantly to the knowledge of digital transformation in banking processes and barriers to digitalization. In addition, it provides bank managers and transformation experts in financial services with a set of potential obstacles to digitalization, which are situated in the context of the digital transformation process at banks. By considering the potential barriers identified in this research, managers may become more aware of obstacles to the digitalization process and monitor them more efficiently.

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ORCID IDs

Florian Ulrich-Diener  <https://orcid.org/0000-0002-7505-3305>

Ondřej Dvouletý  <https://orcid.org/0000-0001-9151-2033>

Notes

1. "Circumstances" are understood as the totality of conditions (e.g., flexibility, age structure, qualification, etc.) that arise in or due to employees.
2. Cooperative banks 26%; Savings banks 36%.
3. Online: <https://www.questionpro.de/>.
4. CxO: C-level positions, sometimes also called "C-Suite," are the top management level of a company. The letters C and O in this context stand for "Chief" and "Officer," as in CEO/Chief Executive Officer, CFO/Chief Financial Officer. It can also include management at lower levels.
5. Because of its extensive layout, it cannot be presented, but is available upon request from the authors.
6. "Cross-loadings of variables (loadings of two factors) can be evaluated by the ratio of their squared loading and classified as problematic (ratio between 1.0 and 1.5), potential (ratio between 1.5 and 2.0), or ignorable (ratio greater than 2.0). Problematic and perhaps even potential cross-loadings are deleted unless theoretically justified or the objective is strictly data reduction" (Hair et al., 2018, p. 158).
7. The items *SMDMP*, *TROIT*, and *SMDS* were eliminated.
8. The items *EFr*, *CT*, *TRU*, *CK*, *KPC*, *Cas*, and *KPEEA* were eliminated.
9. The pattern matrix: factor loadings represent regression coefficients.
10. The structural matrix: correlations between the variables and the factors.

11. What are the barriers to digitalization in an increasingly technological banking environment?
12. What effect do barriers to digitalization have on the degree of digitalization of banks from the perspective of decision-makers?

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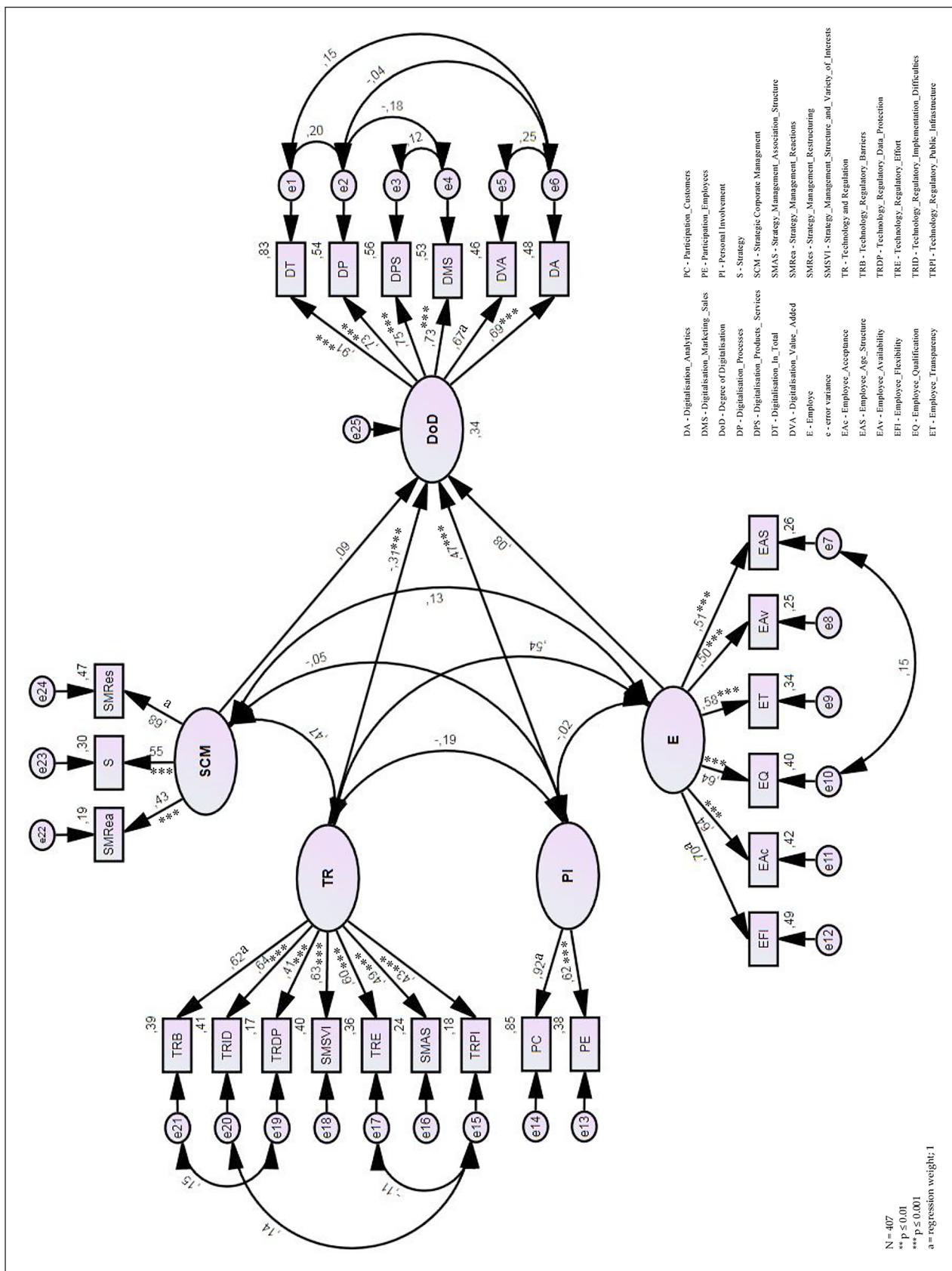
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Appendix I. Estimated structural equation model (full model).