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Business Strategies for the Future

Edited by Mohammad Osman Gani



Navigating the Digital Economy - Business Strategies for the Future

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This series will provide a comprehensive overview of recent research trends in business and management, economics, and marketing. Topics will include asset liability management, financial consequences of the financial crisis and covid-19, financial accounting, mergers and acquisitions, management accounting, SMEs, financial markets, corporate finance and governance, managerial technology and innovation, resource management and sustainable development, social entrepreneurship, corporate responsibility, ethics and accountability, microeconomics, labour economics, macroeconomics, public economics, financial economics, econometrics, direct marketing, creative marketing, internet marketing, market planning and forecasting, brand management, market segmentation and targeting and other topics under business and management. This book series will focus on various aspects of business and management whose in-depth understanding is critical for business and company management to function effectively during this uncertain time of financial crisis, Covid-19 pandemic, and military activity in Europe.

Meet the Series Editor



Prof. Choudhry holds a BSc degree in Economics from the University of Iowa, as well as a Masters and Ph.D. in Applied Economics from Clemson University, USA. In January 2006, he became a Professor of Finance at the University of Southampton Business School. He was previously a Professor of Finance at the University of Bradford Management School. He has over 80 articles published in international finance and economics journals. His research interests and specialties include financial econometrics, financial economics, international economics and finance, housing markets, financial markets, among others.

Meet the Volume Editor



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Preface

Digital transformation is no longer a side project; it is now the operating environment in which organizations compete, governments serve, and consumers make everyday decisions. Across industries, digital technologies are reshaping value creation through data, platforms, automation, and new forms of interaction. However, the same forces that enable growth can also introduce new vulnerabilities: unequal access, rising cyber risks, skills shortages, trust deficits, and governance challenges. This edited volume, *Navigating the Digital Economy – Business Strategies for the Future*, brings together timely perspectives on how organizations and institutions can respond strategically to these opportunities and tensions, with an emphasis on practical pathways, responsible innovation, and sustainable performance.

The chapters in this book collectively highlight a central message: digital strategy succeeds when it connects technology with people, processes, and institutional readiness. On one hand, digital platforms and analytics can enhance decision-making, improve customer experiences, and strengthen competitiveness. On the other hand, rapid digitization can create operational strain, widen digital divides, and amplify systemic risks, especially in settings where infrastructure, policy capacity, and digital skills are still developing. By combining evidence, conceptual insights, and applied recommendations, the contributions in this volume illuminate how organizations can design digital initiatives that are both high-performing and resilient.

A distinctive strength of this volume is its multidisciplinary view of the digital economy. The book addresses digital innovation not only as a technological shift, but also as a managerial, societal, and governance challenge. Readers will find discussions that address business leaders seeking competitive advantage, public-sector decision-makers working to improve digital services, and scholars exploring emerging research agendas on digital transformation. The aim is to help readers move beyond generic “digital adoption” narratives toward a more grounded understanding of what makes digital strategies work in real organizational environments.

As Academic Editor, I am grateful to the chapter authors for their commitment, responsiveness, and scholarly contribution throughout the editorial process. I also thank the publishing team for their guidance and support in bringing this volume to completion. I hope this book serves as a useful reference for researchers, practitioners, and students who are navigating digital change, and that it encourages thoughtful, inclusive, and future-oriented strategies for the evolving digital economy.

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Chapter 1

Digital Minimalism in Business: Doing More with Less in the Age of Tech Overload

Amalia Kouskoura, Eleni Kalliontzi and Ioannis Bakouros

Abstract

In today's digitally saturated business environment, a striking paradox has emerged: while technology is more abundant than ever, it often leads to diminished productivity and increased employee stress. Organizations invest heavily in various digital tools designed to streamline workflows and enhance efficiency. However, these tools can sometimes contribute to fragmented attention spans, cognitive overload, and ultimately reduced work effectiveness. This chapter proposes digital minimalism as a strategic framework to address these challenges by promoting purposeful and selective use of technology. Digital minimalism encourages businesses to critically evaluate their technological landscape and prioritize tools that truly align with their core objectives and employee needs. Grounded in well-established theoretical foundations such as the technology acceptance model and socio-technical systems theory, this approach highlights the importance of aligning technological tools with social and organizational contexts to foster meaningful adoption and reduce unnecessary digital noise. Through a rigorously detailed mixed-methods research design, including cross-industry case studies, a total of 240 employees surveyed, and in-depth interviews, this chapter provides evidence of digital minimalism's positive impact on productivity, focus, and stress reduction. Furthermore, it offers practical implementation strategies alongside evidence-based recommendations that empower organizations to optimize their technology use. Ultimately, by embracing digital minimalism, businesses can achieve sustainable competitive advantages by "doing more with less," enhancing both organizational performance and employee well-being in an increasingly complex digital world.

Keywords: digital minimalism, technology overload, organizational theory, technology acceptance model, employee well-being

1. Introduction

The digital revolution has profoundly transformed modern business operations, enabling unprecedented levels of connectivity, real-time data access, and

automation [1]¹. These advancements have opened new avenues for efficiency, collaboration, and innovation. However, alongside these benefits, the rapid proliferation of digital tools and platforms has introduced significant challenges. Employees now navigate an overwhelming array of communication channels, frequent notifications, and the expectation of constant availability [2]. This persistent digital bombardment often leads to cognitive overload, fragmented attention, increased stress, and, ultimately, reduced overall productivity. This phenomenon, widely known as technology or digital overload, threatens not only individual employee well-being but also broader organizational effectiveness and competitiveness.

Digital minimalism, a concept gaining traction in recent years, presents a strategic response to these challenges [3]. At its core, digital minimalism advocates for a deliberate and mindful approach to technology use – prioritizing essential digital tools that add clear value while minimizing or eliminating unnecessary digital distractions. While traditionally associated with lifestyle choices centered on simplicity, minimalism’s application within business settings is increasingly recognized as a powerful means to enhance employee focus, improve collaboration, and stimulate innovation [4].

In today’s fast-paced work environment, where multitasking is often celebrated, the consequences of digital saturation are becoming more evident [5]. Research in cognitive psychology suggests that constant switching between tasks – commonly referred to as “context switching” – leads to mental fatigue, decision fatigue, and ultimately a decline in work quality. Moreover, digital tools that promise efficiency can become counterproductive when overused or poorly integrated [6, 7]. For instance, overlapping project management systems or excessive email threads can obscure information rather than clarify it, contributing to employee disengagement and burnout.

Addressing these issues requires a shift in organizational mindset [7]. Rather than defaulting to “more is better” when it comes to digital tools, companies must begin to ask which technologies truly support strategic objectives and employee performance [8]. Digital minimalism provides a framework for conducting this kind of an assessment [9, 10]. By eliminating redundancy, consolidating platforms, and focusing on high-impact tools, organizations can create a more streamlined digital environment. This not only enhances clarity and reduces digital noise, but also empowers employees to work more intentionally and productively.

This chapter seeks to bridge the gap between theoretical frameworks and practical application by integrating digital minimalism within established organizational models. The technology acceptance model (TAM) offers valuable insights into how individuals decide to adopt and use technology based on perceived usefulness and ease of use [11, 12]. Meanwhile, socio-technical systems (STS) theory underscores the intricate interplay between social dynamics and technological tools within organizations. By combining these perspectives, the chapter explores the conditions and organizational environments conducive to the successful adoption and sustainable implementation of digital minimalism.

Our research employs a mixed-methods design to provide a comprehensive understanding of digital minimalism’s impact. Data were gathered through detailed case studies of four companies spanning diverse sectors – including technology, finance, healthcare, and retail – each selected for their active engagement in digital minimalism initiatives. Selection criteria included company size, digital maturity, and willingness to participate in surveys and interviews.

² This chapter is funded by the HORIZON programme, 4Sir2 Smoothy project.

Importantly, our findings suggest that digital minimalism is not a one-size-fits-all solution but rather a flexible approach that must be tailored to organizational culture, industry norms, and employee roles [13]. For example, a customer service team with high interaction volume may benefit from real-time tools with limited customization, while a software development team might need fewer but more configurable platforms that support deep work. Understanding these nuances is critical to ensuring long-term success and adoption.

The subsequent sections delve into the conceptual foundations of digital minimalism, analyze the detrimental effects of technology overload on organizational performance, present actionable implementation strategies, and showcase the tangible benefits experienced by businesses embracing digital minimalism. This comprehensive exploration aims to demonstrate how organizations can achieve enhanced efficiency, employee well-being, and competitive advantage by thoughtfully “doing more with less” in their digital environments.

2. Understanding digital minimalism: Conceptual foundations and theoretical frameworks

Digital minimalism is a deliberate philosophy and practice aimed at reducing digital clutter to focus attention on what truly matters [14]. Rather than rejecting technology altogether, it advocates selective and purposeful use of digital tools, which contrasts sharply with the “more is better” approach common in modern businesses [15]. This approach aligns with the principle of “doing more with less,” emphasizing quality over quantity in technology adoption.

In an era of app proliferation, cloud-based services, and real-time communication, digital minimalism promotes clarity, intentionality, and sustainability in the digital environment [16]. For organizations overwhelmed by redundant platforms, overlapping systems, and constant notifications, digital minimalism presents a strategic and humane alternative.

2.1 The core principles of digital minimalism

At its core, digital minimalism is built on three foundational principles [17]. These principles are as follows:

- **Intentionality:** Using digital tools deliberately and with clear purpose, avoiding mindless or habitual usage. This principle encourages employees and organizations to regularly audit their digital behaviors and workflows, identifying which tools truly support their objectives.
- **Simplicity:** Minimizing the number of technologies and applications to reduce complexity and distractions. A leaner digital environment supports quicker onboarding, easier collaboration, and a lower cognitive load.
- **Focus:** Prioritizing tools and workflows that enhance concentration and productivity, rather than fragmenting attention. When employees can work without constant digital interruptions, deep work and creativity flourish.

Together, these principles serve as a guide for organizations seeking to redesign their digital ecosystems to better support employee well-being and business goals. For example, replacing five overlapping platforms with one integrated system can significantly enhance operational coherence and reduce digital fatigue.

2.2 TAM and digital minimalism

The technology acceptance model is widely used to explain how users come to accept and use technology [18]. TAM posits that two key factors influence technology adoption: perceived usefulness (PU) and perceived ease of use (PEOU) [19]. In the context of digital minimalism, these factors are critical.

Employees are more likely to embrace minimalist technology if it is perceived as genuinely useful – helping them achieve goals more efficiently – and easy to use without unnecessary complexity. For example, a streamlined project management tool that consolidates communication and task tracking is more likely to be adopted than a feature-rich platform that requires extensive training and effort.

Digital minimalism encourages organizations to evaluate each technology's contribution to PU and PEOU, discarding tools that fail to meet these criteria [20]. This selective process ensures that technological environments are purpose-built, rather than cluttered with legacy systems or novelty applications.

Moreover, organizations practicing digital minimalism often see higher engagement levels from employees who feel empowered rather than overwhelmed by their tools. TAM, therefore, becomes an important filter through which organizations can assess digital value and user acceptance.

2.3 STS theory and organizational context

Socio-technical systems theory views organizations as composed of interrelated social and technical elements. Successful technology adoption depends on harmonizing these elements – people, tasks, structures, and technology [21]. Digital minimalism supports this balance by simplifying the technical side to better fit social needs.

Rather than imposing technology on users, a digital minimalist approach considers how employees naturally work, communicate, and collaborate. Tools are selected not just for functionality but for cultural alignment and workflow compatibility. For example, a small nonprofit may not need a large enterprise resource planning (ERP) system but could thrive with a lightweight collaboration suite tailored to its specific needs [22, 23].

By reducing the number of tools and focusing on those that align with organizational workflows and culture, businesses can minimize friction, increase acceptance, and improve overall system performance. STS theory underscores that technology solutions must be designed with human and organizational factors in mind – a central idea within digital minimalism. It also reinforces the importance of continuous feedback loops, where employees are involved in evaluating and refining digital practices.

2.4 Integrating theory with practice

The integration of TAM and STS theory provides a robust conceptual framework for understanding and implementing digital minimalism in business [24]. TAM helps

identify which technologies are most likely to be adopted and valued by users, while STS theory guides the alignment of technology with organizational social dynamics.

This dual-theoretical perspective supports a research-driven approach to digital minimalism, ensuring that decisions about technology use are not based solely on anecdote or trends but on measurable factors such as usability, usefulness, social fit, and organizational effectiveness.

By using TAM to evaluate potential tools and STS to guide implementation, organizations can move beyond surface-level solutions and build cohesive, efficient digital environments that truly serve their people and their goals [25].

3. The challenges of technology overload in business

3.1 The nature of technology overload

In today's fast-paced business environments, employees are often expected to manage multiple digital platforms simultaneously – email, instant messaging, project management tools, enterprise resource planning systems, customer relationship management dashboards, and even social media for brand-related tasks [26]. While these technologies are designed to streamline communication, improve transparency, and facilitate real-time coordination, their sheer volume and constant demand for attention frequently produce the opposite effect.

Technology overload refers to the cognitive burden and emotional stress that arise when individuals are exposed to excessive digital stimuli [27]. This overload manifests in various ways, such as fragmented attention, difficulty prioritizing tasks, reduced ability to focus deeply, delayed response times, and, ultimately, chronic fatigue or burnout. In severe cases, it can lead to decision paralysis or disengagement from work. The constant “always-on” expectation, particularly prevalent in remote or hybrid work settings, further exacerbates these symptoms, blurring boundaries between professional and personal life [28].

For businesses, these effects go beyond the individual. Technology overload undermines team coordination, weakens client communication, and hampers leadership effectiveness. Its systemic nature means that even highly capable professionals may underperform in a chaotic digital landscape.

3.2 Quantifying the impact

Empirical research highlights the measurable toll of digital saturation [29]. Studies show that the average knowledge worker switches tasks every 2 to 3 minutes, often triggered by pings, pop-ups, and alerts. Each interruption incurs a recovery time – often 20 minutes or more – before regaining full focus. This results in significant productivity losses across an organization.

Key performance indicators (KPIs) such as task completion rates, deep work hours, and time spent on strategic thinking all decline in environments dominated by digital clutter [30]. Surveys further confirm that employees experiencing high volumes of digital interruptions report lower job satisfaction, increased stress, and a greater desire to disengage or seek employment elsewhere. Additionally, many employees resort to using “workarounds” or shadow IT tools to avoid bloated platforms, which can create security risks and data fragmentation.

From an economic standpoint, the cumulative effects of inefficiency, disengagement, and turnover can be costly [31]. One estimate suggests that digital distraction costs U.S. companies over \$650 billion annually in lost productivity. These figures underscore the urgency of adopting smarter, leaner approaches to digital work, such as structured digital minimalism programs evaluated in this research.

3.3 Organizational implications

For businesses, technology overload is not merely an individual issue but a deeply embedded organizational challenge [32]. Its origins are often rooted in well-intentioned but poorly coordinated digital transformation efforts, where new tools are added without adequately retiring or integrating existing ones. This results in redundancy, fragmented workflows, and inconsistent digital practices across teams.

Moreover, many organizations lack clear digital governance policies or structured onboarding programs that help employees navigate the growing digital ecosystem [33]. As a result, teams may use the same tool differently – or worse, duplicate work across multiple platforms. This misalignment breeds inefficiency and often leads to siloed communication, slowed decision-making, and weakened organizational coherence.

There are also health-related implications. Prolonged exposure to digital overload has been linked to increased stress hormones, sleep disturbances, and even symptoms of anxiety and depression. These outcomes translate into higher absenteeism, increased health insurance claims, and rising occupational health concerns.

To address this, organizations must adopt a holistic approach to digital well-being, including structured digital minimalism interventions [34]. Conducting digital audits to identify tool redundancies, setting clear boundaries around digital availability (e.g., “no meeting” blocks or email curfews), and fostering a culture that values deep, focused work are key strategies. Leadership must model intentional digital behavior, demonstrating that productivity stems from meaningful engagement rather than constant activity.

By acknowledging the systemic nature of technology overload and responding with structural, cultural, and technological solutions, businesses can transform their digital environments from sources of stress into enablers of sustainable performance and employee well-being.

4. Research approach and methodology

4.1 Research design

To examine the practical applications of digital minimalism in organizational settings and its potential impact on productivity and employee well-being, this chapter adopts a mixed-methods research design [35]. This approach combines qualitative and quantitative methodologies to provide a balanced and in-depth understanding of the topic.

The qualitative dimension of the study aims to uncover the lived experiences, perceptions, and behaviors of individuals and teams within organizations engaging in digital minimalism. This is achieved through exploratory methods that capture the richness and complexity of real-world contexts.

The quantitative component complements this by offering broader patterns and measurable insights into the use of digital tools, perceived stress, and productivity-related factors. Together, these methods allow for nuanced exploration and generalizable findings, ensuring that other researchers can replicate the study by following similar survey and interview protocols.

4.2 Case study orientation

To ground the research in practice, organizations from various sectors were examined to ensure diversity in operational contexts and digital cultures [36]. These organizations were selected based on their engagement with digital streamlining efforts, such as tool simplification, reduction of platform redundancy, or broader digital wellness initiatives. Four companies from diverse sectors (technology, finance, healthcare, retail) were selected based on their engagement with digital minimalism initiatives, size, digital maturity, and willingness to participate.

Rather than focusing on specific industries or technologies, the intention was to capture varied approaches to managing digital complexity. This allowed for the identification of both universal principles and context-dependent adaptations of digital minimalism in the workplace.

4.3 Data collection strategies

A combination of qualitative and quantitative data collection techniques was used to ensure depth, breadth, and triangulation [35]. These are as follows:

- **Interviews** were conducted with employees and managers across different functions to gain insights into how digital tools are used, what challenges are encountered, and how digital minimalism is perceived and supported within the organization. These conversations helped illuminate both formal strategies and informal practices.
- **Observations** of daily work routines provided valuable information about the practical use of digital systems, communication patterns, and the nature of workplace interruptions. This offered a grounded perspective on how digital environments affect focus and task flow.
- **Surveys** were distributed to a total of 240 employees across four companies (60 per company). The survey included 20 items measuring perceived digital overload, tool usability, and productivity impacts, using a 5-point Likert scale. Selection criteria for the participating companies included engagement in digital minimalism initiatives, diverse industry representation, and willingness to provide access to internal workflows. These methods ensure that other researchers can replicate the study by applying similar survey items and sampling strategies.
- **Organizational insights** – such as feedback reports, internal guidelines, or performance metrics – were reviewed, where available, to contextualize findings and align them with broader organizational objectives.

4.4 Analytical framework

Qualitative data were organized thematically, identifying recurring narratives, common challenges, and divergent perspectives [37].

Quantitative data explored relationships between digital tool use, attention, stress, and perceived performance. This dual-lens methodology strengthens validity and provides actionable insights [38].

By using this dual-lens methodology, the research gains both depth and scope, allowing conclusions to be grounded in practical experiences while supported by measurable indicators. This multi-layered approach strengthens the credibility, transferability, and validity of the study's findings, offering meaningful guidance for organizations interested in implementing digital minimalism as a strategic and human-centered practice. These methodological details improve transparency and reproducibility, and they allow peers to replicate the study in different organizational contexts.

5. Implementing digital minimalism in business: Strategies and best practices

Putting digital minimalism into action in a workplace takes planning and a change in how people think about technology. It is not just a one-time project – it is an ongoing process that should grow and adapt along with the company and its employees [39]. Below are some key strategies that can help make digital minimalism work in practice.

5.1 Reducing and organizing digital tools

A good first step is to look at all the digital tools the company uses and see which ones are needed [40]. Many businesses use too many apps or platforms that do similar things, and this can confuse employees, slow down work, and require extra training.

This process – often called tool rationalization – involves going through all the tools, deciding which ones are useful, which overlap, and which can be removed or combined. It is helpful to ask employees for their opinions, since they use these tools every day.

Another important part is digital decluttering. This means encouraging employees to clean up their digital spaces. For example, they can:

- Turn off notifications that are not necessary;
- Delete or hide unused apps;
- Unsubscribe from unimportant emails or chats; and
- Organize digital files.

Some companies even set up special “declutter days,” where teams take time to clean up their digital workspaces together.

5.2 Creating healthy digital boundaries

To help employees avoid feeling overwhelmed by constant messages and alerts, it is important to set some clear digital boundaries [41, 42]. These are simple rules or guidelines about how and when digital tools should be used. For example:

- Set “focus hours” during the day when people can work without being interrupted.
- Avoid sending emails during evenings or weekends.
- Ask employees to turn off push notifications while doing deep work.
- Use shared documents or project boards instead of expecting instant replies.

These practices protect people’s time and attention, and they also help create a healthier work-life balance.

5.3 Training and shifting the workplace culture

Digital minimalism is not just about tools – it is also about changing habits and the way people think [43]. For this reason, training is very helpful. Companies can organize short workshops or webinars to teach employees about focused work, time management, and how to use technology more mindfully.

Leaders play a big role too. When managers follow these habits themselves – for example, by not sending messages after work or by using fewer tools – it sends a strong message to the rest of the team.

Changing a company’s culture takes time, but with consistent effort and good communication, real progress can be made.

5.4 Leveraging technology to reduce overload

Although digital minimalism focuses on reducing digital noise, it does not mean rejecting technology altogether [44]. In fact, some tools can actively support minimalist practices. These include the following:

- Distraction-blocking apps that limit access to social media or news during work hours.
- Email filters that sort low-priority messages or summarize updates.
- Integrated dashboards that unify communication streams to reduce context-switching.

The key is to select tools that simplify rather than complicate workflows. Organizations should also regularly review the use of these tools to ensure they are still meeting their intended purpose and not contributing to further overload.

5.5 How to know if it is working?

To see if digital minimalism is having a positive impact, companies need to track progress [45]. This can be done by looking at both numbers (like how fast tasks are finished or how often employees are absent) and by collecting feedback from staff. Some useful ways to measure success include the following:

- Quick surveys asking employees how focused or stressed they feel;
- Team check-ins to talk about what's working or what's not; and
- Comparing results before and after introducing digital minimalism changes.

In the end, it is not only about better numbers. True success means building a workplace that feels calm, focused, and supportive – a place where employees can do their best work without feeling constantly overwhelmed by digital noise.

6. Conclusions

Digital minimalism offers a structured and evidence-based approach for businesses to manage the overwhelming flood of digital tools and information that employees face daily. Instead of adding more platforms or expecting workers to juggle countless apps, this approach encourages organizations to carefully select and use only the technologies that truly support employee focus and productivity. Our mixed-methods research demonstrates measurable reductions in cognitive overload, stress, and task-switching, alongside improvements in overall work efficiency.

A key insight from this research is that digital minimalism is not a fixed formula but must be adapted to organizational culture, industry requirements, and specific job roles. For example, a customer service team with high interaction volume may require real-time communication tools, while software developers benefit from fewer but more configurable platforms that support deep work. Tailoring digital minimalism to these nuances ensures sustainable adoption and long-term benefits.

Another important aspect highlighted is the human-centered dimension of technological use. Theoretical frameworks, such as the TAM and STS theory, reinforce that effective digital tools are not solely defined by their features but by their alignment with employee workflows, organizational practices, and social dynamics. Aligning technology selection with these factors reduces resistance, increases adoption, and enhances overall organizational performance.

The HORIZON project, 4Sir2 Smoothy, exemplifies practical implementation by integrating digital minimalism principles into its innovation process. By focusing on sustainable, efficient technologies that enhance productivity without causing overload, 4Sir2 supports a healthier work environment while pursuing innovative objectives. This demonstrates the feasibility of balancing technological advancement with employee well-being in real-world contexts.

Effective digital minimalism also requires cultural and behavioral change. Establishing clear digital boundaries (e.g., focus hours, limited after-hours communication), ongoing employee training, and leadership modeling of minimalist practices are essential for long-term success. When leaders actively demonstrate

mindful technology use, it signals organizational commitment and encourages employees to adopt similar practices.

Technology itself can still be leveraged as a tool for minimalism. Distraction-blocking apps, smart email filters, and integrated dashboards help streamline workflows while minimizing unnecessary context switching. Regular review and adjustment ensure these tools remain effective and do not inadvertently contribute to overload.

Finally, measuring the impact of digital minimalism should go beyond productivity metrics. Employee feedback, stress levels, satisfaction, and overall workplace atmosphere are equally important indicators. When implemented thoughtfully, digital minimalism creates a calmer, more focused, and supportive work environment that benefits both employees and the organization.

Future research directions include exploring digital minimalism in remote and hybrid work settings, examining its integration with AI-driven tools, and investigating cross-cultural adoption patterns. Such studies will further enhance the generalizability of findings and refine practical guidance for diverse organizational contexts.

In conclusion, digital minimalism provides a powerful framework for doing more with less – enhancing focus, reducing stress, and improving organizational performance in the modern digital workplace.

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¹¹ <https://www.trinka.ai/grammar-checker>.

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Chapter 2

The Rapid Growth of Digital Banking Services on Customer Behaviour and Satisfaction in South Africa

Andrew Enaifoghe

Abstract

This chapter looks at the impact of the rapid growth of digital banking services on customer behaviour and satisfaction. Studies indicate that the rapid growth of digital banking services has transformed the banking industry, altering how clients interact with financial institutions and contributing to the development of the digital economy. This study report aims to assess the influence of digital banking on consumer behaviour and satisfaction. The study analyses changes in customer preferences, behaviours, and attitudes regarding digital banking platforms using a thorough literature analysis, quantitative surveys, and qualitative interviews. The survey also examines the factors influencing customer satisfaction with digital banking services, including the simplicity of use, security, accessibility, and tailored experiences. The study employed a qualitative approach, utilizing semi-structured questionnaires to collect data from selected individuals. The study randomly assigned 20 working individuals in South Africa who answered an open-ended question that elicited insightful comments and replies about the following elements influencing consumers' choices to engage in internet banking. The findings shed light on the transformative consequences of digital banking on customer behaviour, with important implications for banks and financial institutions seeking to enhance customer satisfaction and loyalty in an increasingly digital world. The study concluded that digital banking significantly impacts customer behaviour and satisfaction, primarily by providing increased convenience, accessibility, and personalisation through features like mobile banking apps, online platforms, and data analytics, leading to higher engagement.

Keywords: customer behaviour, satisfaction, online transactions, mobile banking, digital transformation

1. Introduction

Given the rapid advancement of information technology, the banking industry is accelerating digital transformation, altering the customer experience, and restructuring the competitive landscape. This article investigates the impact of digital

banking services on consumer satisfaction, concentrating on the three main characteristics of ease, security, and customisation. Customer satisfaction is a multifaceted and intangible notion, characterized as a customer's emotional response to a product or service following consumption. The expression of pleasure may differ due to individual, economic, and psychological influences, along with the calibre of service given [1]. Content consumers are likely to remain loyal to the firm, engage in repeat purchases, and disseminate favourable word-of-mouth, which is particularly crucial in competitive sectors [2].

In banking, client happiness is crucial to loyalty and economic performance [3]. To enhance customer satisfaction, banks must improve service quality, which may be accomplished through using self-service technologies (SSTs) like internet banking and mobile banking. These technologies enable users to execute financial transactions at their leisure, conserving time and enhancing pleasure. Customer happiness is determined by service dependability, security, and the overall user experience [4]. In the banking sector, customer satisfaction is the degree to which a product or service fulfils or surpasses a client's expectations [5]. Customers frequently assess their happiness post-service utilization, considering service quality, convenience, and trustworthiness.

It corresponds with the findings of [6], who characterized contentment as a favourable emotion resulting from service consumption. Digital banking has a significant positive impact on customer behaviour and satisfaction, primarily by providing increased convenience [7], accessibility, and personalisation through features such as mobile banking apps [8], online platforms, and data analytics, leading to higher engagement. Digital banking also helps increase transaction volume and overall customer loyalty, provided that security concerns are adequately addressed; however, ensuring user-friendly interfaces and addressing potential digital divides remain significant challenges [9].

1.1 Literature considerations

Scholars believe that in the global banking sector, the progress of technology and the digital transformation of banking companies have become the main development trends [10]. Along with altering consumers' financial service experiences, digital banking services – including online banking transactions, mobile apps, self-service terminals, and artificial intelligence-driven customer services – have fundamentally changed the competitive landscape of the banking sector. Maintaining a competitive advantage and sustained development depend primarily on customers' happiness with banks. This increases client lifetime value and impacts direct customer retention, recommendation behaviour, and the likelihood of effective cross-selling.

Thus, there is considerable practical relevance in researching how digital banking services impact client satisfaction [11]. Globally, the encouragement of digital banking solutions has sped up considerably. Reports from 2022 indicate that over 360 million individuals worldwide have started using mobile devices or computers for online banking services, demonstrating the increasing usage of digital banking services [12]. Furthermore, changes in consumer requirements, technological advancements, and pressure from competitors encourage the digital transformation of established banks. One of the primary measures of a bank's success is customer satisfaction, which is directly related to customer loyalty and the bank's market share.

Consequently, analysing the link between digital banking services and customer satisfaction enables banks to assess present service performance and direct their future product development and improvement strategy. Many consumers began using online and mobile banking services during the outbreak; a poll revealed that more than 70% of bank clients had increased their use of digital channels for transactions. The challenges encountered by customers in the previous year led to a significant increase in digital appointment scheduling, with 2.6 million individuals planning both in-person and virtual consultations, reflecting a 14% year-over-year growth. Since April 2020, 25% of traffic to the financial centre has been attributed to the company's bank due to adopting digital banking features [13].

Furthermore, worldwide e-commerce revenues are anticipated to attain \$6.4 trillion by 2025, mostly propelled by mobile and social commerce. Digital advertising expenditures are anticipated to exceed \$500 billion, with certain forecasts estimating they might reach \$1.1 trillion by 2030. Moreover, it is anticipated that more than 50% of substantial transactions would transpire via digital self-service channels. The expansion and widespread acceptance of the internet and online technologies in recent decades have created several opportunities for corporate digitalization and the development of new digital business models [14].

Consequently, enterprises globally are undergoing transformation and reorganization due to the emergence of the Fourth Industrial Revolution (4IR), with banks also being affected. Banking consumer services, including those provided through digital channels such as websites, Internet banking portals, and smartphone applications, are becoming progressively more dependent on technology. Banks may forfeit the value advantages provided by conventional in-person interactions, due to traditional business strategies that require clients to visit a bank office [5].

Furthermore, the distinctive attributes of digital services suggest that customer evaluation techniques differ from those employed in the assessment of tangible products [15]. Consequently, organizations are recognizing that the intangible elements of relationships fostered through digital channels and services are not simply replicated by competitors, thereby offering a sustained competitive advantage [16]. In banking consumer services, value outcomes – actual and perceived – serve as fundamental foundations for the establishment of the firm [5].

A business strategy that addresses varied human traits and values via digital channels is crucial in digitalizing a bank's customer services [5]. This observation suggests that digital technologies are fundamentally transforming the global banking sector by obscuring the conventional distinctions of product, market, and customer base [17], thus liberating and harmonizing financial systems worldwide [18].

Consequently, in the context of extensive structural transformation and technical advancement, banks often respond to the evolving competitive landscape by pursuing diversification, vertical product differentiation, and consolidation [19]. In some cases, new technology and services may pose a danger to entirely supplant traditional banks. Internet or digital-only banks provide alternative methods for online transactions and banking by offering services solely through online platforms (websites) or smartphone applications, thereby contesting conventional banking models by obviating the necessity for physical bank branches.

Technology has fundamentally transformed the creation, delivery, reception, and utilization of financial products [17], with convenience and economic efficiency positively influencing consumers' intentions to adopt and continue using international digital-only banks [20]. In light of this and the emergence of the Fourth

Industrial Revolution, conventional banks may face heightened challenges in expanding and maintaining their customer base while simultaneously catering to the diverse expectations of consumers through the digitalization of services [21]. The ongoing implementation of novel offline, online, and mobile value-added services is essential for customer pleasure, retention, and perhaps business continuity [19].

The fast advancement of technology necessitates the judicious selection of digital platforms and tools to facilitate extensive user adoption, acceptability, and overall success [14]. Nonetheless, an intrinsic risk exists, particularly from a cyber and information security standpoint, when using new technology or solutions. As early adopters accept and mitigate this risk, further pressure may be exerted on competitors to conform [16]. As other important sector players implement analogous technology-first efforts, patterns may emerge, eventually shaping customer expectations.

Notwithstanding the previously mentioned perceived risks, digital-only banks disrupt the conventional banking sector by introducing innovative and cost-effective products, facilitated by reduced operational expenses through outsourcing to affiliates, such as supermarkets, that possess established infrastructure and extensive reach [5, 22]. Utilizing outsourcing for significant infrastructure enables the supply of bank accounts with minimal or no monthly maintenance expenses. Therefore, the emergence of these unforeseen entities in the financial services sector has established a “marketplace without limits” [23]. This indicates that non-traditional entities are progressively seeking new possibilities, allowing them to contest established firms and perpetually altering the landscape of financial services in South Africa [23].

Traditional banking business models, which primarily necessitate client visits to physical branches, are arguably facing challenges. However, due to the recent introduction of the digital-only banking concept in South Africa in 2019, there is a paucity of research literature on the subject from a South African viewpoint. To rectify this deficiency in the current South African research literature, we examine the South African banking sector and assess the developments in digital consumer services provided by a range of conventional, offline banks.

1.2 Global e-commerce

As reported in a LinkedIn post on digital marketing statistics, projected global e-commerce sales are anticipated to reach \$6.4 trillion. This expansion is driven by rising internet usage and accelerated connection speeds, particularly in areas such as South Africa, where e-commerce is witnessing significant development.

According to **Table 1**, digital channels constitute a significant share of total advertising expenditure, with online spending surpassing \$790 billion in 2024, as reported by DataReportal. Meanwhile, self-service channels tend to underscore the increasing inclination for easy and on-demand access to information and services [24]. The influence of social media remains a formidable element in digital marketing. In South Africa, individuals are progressively utilizing social media to investigate firms, highlighting the necessity for seamless interaction between social platforms and sales channels [4]. According to Shapo, almost 78% of customers indicate that social media posts affect their shopping decisions.

According to [4], AI-powered bots assess user behaviour instantaneously to enhance conversion rates. As a LinkedIn post on digital marketing data shows, a

Digital advertising	Global expenditure on digital advertising is projected to surpass \$500 billion, with certain projections predicting it may attain \$1.1 trillion by 2030, as reported in a LinkedIn post on digital marketing statistics
Self-service channels	Forrester forecasts that over 50% of significant transactions will be executed via digital self-service channels by 2025, as reported by SuperOffice CRM
Artificial intelligence and personalization	Artificial Intelligence is increasingly integral to e-commerce, as several prominent platforms employ it for customized storefronts, dynamic pricing, and product suggestions
Search engine optimization	SEO is an essential component of digital marketing, as organic search generates substantial website traffic
Video marketing	Video content is becoming popular, with more than half of Instagram users dedicating 60% of their time to viewing videos

Table 1.
Global e-commerce.

substantial share of e-commerce sales in 2025 is projected to originate from mobile devices and social media platforms. This underscores the necessity of enhancing online visibility for mobile consumers and utilizing social media for product identification and sales. According to a LinkedIn post on digital marketing data, 76% of mobile searchers in South Africa visit a local company within one day of their search [25]. According to SEO.com, 86% of firms utilize video as a marketing tool, with 92% deeming it a crucial component of their strategy [26].

2. Digital banking services and customer satisfaction

The digital revolution introduced fintech, innovative financial technology solutions that have fundamentally impacted traditional financial services [27]. Digital transformation encompasses external banking procedures and those aimed at bank consumers. A crucial aspect of digital transformation in banking is internal digitalization, which entails the digitization of internal procedures and activities. The internal digitization of a bank must be effectively conveyed to workers to facilitate a seamless transition.

Cele and Kwenda [28, 29], examined the use of digital technology by bank personnel in their research. Their objective was to elucidate the perspectives of bank personnel concerning emerging technology. The financial services sector has seen considerable and persistent turmoil. Financial institutions are seeking ways to address the rising demands of clients resulting from the widespread adoption of digital technology. Banks now face competition from technology businesses, start-ups, telecommunications firms, and others in the banking services market. Banks have transitioned from conservative, inflexible, and closed institutions to being creative, inventive, and flexible entities.

The one enduring constant is the central bank as the paramount regulator. Nonetheless, the regulation of financial services is evolving globally to accommodate the emerging requirements of consumers. Retail banking is undergoing significant transformations. Banks should prioritize and proactively adapt to three critical areas: technological change, data-driven client engagement, and widespread trust [30]. Digital banking services provide numerous advantages compared to traditional

banks, including availability, mobility, time efficiency, accessibility of services, and autonomy in banking relationships.

Digital banking reduced service costs, enhanced interest rates on deposits, online bill payment, awareness of banking products, technological inclusivity, and environmentally sustainable practices [31]. Researchers have emphasized the impact of digital banking on a bank's financial performance [32]. The variables employed were online client deposits, online banking transactions, internet fees and commissions, and internet banking expenditures, with return on assets serving as the metric for financial performance.

Bank performance is assessed as an intersection of digitization and sustainability in the banking sector [33]. This study demonstrates a significant association between investment in bank digitization and financial performance. Additionally, several writers examined the perspective of the intricate relationship between digitalization, operational efficiency, and customer experience [e.g., Bueno et al. 34]. The authors examined the impact of consumers' functional, psychological, and emotional hurdles on the use of digital banking services to elucidate the motivations for their adoption [35].

All hurdles, except functional barriers, positively impact the sustained utilization of digital banking services [36]. Neves et al. [37] investigated the utilization of digital financial services, including digital banking, digital payment management services, and digital wallets. Their findings revealed that cultures emphasizing monetary values are more likely to utilize these services when they are perceived as user-friendly. While digital banking services offer various advantages to users, they have significantly altered customer perceptions and behaviours. Banks must prioritize customer happiness and ensure retention through digital banking services [Kaur et al. 38, p. 16].

Digitalization has revolutionized banking operations, goods, and services. In response to escalating client demands, banks are creating novel offerings to guarantee customer happiness [39]. Previous research on customer satisfaction in digital banking has predominantly concentrated on the quality of online banking services [40], the efficiency of transaction processing [41], or the impact of customer satisfaction on retention rates within banks [42]. This study contends that notable disparities exist in consumer satisfaction levels, considering specific aspects of digital banking services, the dangers connected with digital banking, and client expectations thereof.

2.1 Obstacles and prospects

Although South Africa's digital ecosystem is replete with potential, obstacles remain. The digital gap persists as an obstacle, with rural regions behind metropolitan centres in terms of access and pricing. Cybersecurity dangers intensify with increasing dependence on digital platforms, requiring strong safeguards to preserve confidence [14]. Moreover, changing requirements need that organizations remain adaptable and compliant. South Africa's digital evolution in 2025 highlights its durability and agility. With over 79% of the population online, a mobile-centric culture, and a flourishing social media landscape, the country has abundant opportunities for enterprises poised to innovate [20]. By adopting these trends and confronting the issues directly, companies may cultivate stronger connections, improve engagement, and attain enduring success in this continuously changing digital landscape.

Concurrent with the development of technologies such as artificial intelligence, big data analysis, blockchain, and cloud computing, established banks have been digitally transformed, generating research requirements for new digital banking models [8, 43]. Extensive technology businesses and fintech startups also provide innovative financial services, thereby creating direct competition for established banks and compelling them to pay more attention to digitizing consumer experiences and services if they want to remain competitive.

The foregoing statistics and trends suggest that the digital transformation of banking companies has become irreversible, as digital technology continues to evolve and consumer needs expand. However, the digital revolution in banking is more crucially related to client pleasure than technological progress. Eriksson von Allmen et al. [44] focused on educated and working women between 25 and 45 years old residing in the Bhilwara region of the research area, 86% used online banking services. The simplicity, dynamism, quick emergency assistance, and low cost of online banking services helped explain their great popularity.

Consumers also believe that Internet banking systems eradicate prejudice against the banks they use. However, e-banking services have several disadvantages, including high transaction volumes and consumer scepticism regarding the relevance of checks. Customer satisfaction is much influenced by dependability, management, responsiveness, and security. This study provides an insightful analysis of consumer satisfaction factors, offering banks guidance on enhancing their digital banking offerings.

Kotagiri [45] highlighted the significant influence of social media on banks, particularly in areas such as communication, marketing, publishing, and interaction. Local commercial banks in Malaysia engage with their clients on social media sites. In his case study of a commercial bank in the Mekong Delta (Vietnam), ref. [46] uncovered the elements influencing employee engagement and organisational loyalty. The study found, in decreasing order of importance, the following factors affecting the employee retention rate of current clients: pay, work characteristics, work environment, colleagues, and management. In all spheres, the location, degree of service quality, and financial success of a bank significantly affect the opinions of its customers.

Customers typically migrate when the earnings or interest rates that rival banks offer fall short. Likewise, consumers respond similarly to poor service quality and banks with just one branch or branches spread far from the city centre [47, 48]. The evaluation suggests that internet control may be facilitated with the assistance of the financial institution. Ethnic groups believe that the interaction between consumers and banks depends more on the human touch. However, people use web-based finance managers to save time, migrate from cash storage and withdrawal lines, and examine needs on financial institution pages without difficulty. For cash change, most people choose Google Pay.

At the core of online banking, trustworthy performance depends critically on happy consumers [49, 50]. George [51] claims that accessibility, privacy, customer value, trust, and attitude are strongly linked to consumer satisfaction with snapdeal.com in India and lazada.com in Thailand. Trust was crucial for Thai consumers' sense of value and Indian customers' level of happiness. Every factor correlates with satisfaction. Thais and Indians' content speaks to most traits. Though trust and India are closely linked, privacy is not especially favourably associated with India.

Previously thought to be an excellent indicator of consumer loyalty, relationship marketing has been found to correlate positively with customer loyalty. This is so since different banks apply identical forgetting-to-know-customer techniques, while product customisation is rare. Consequently, relationship marketing appears uniform across all banks, and consumers may be unable to switch service providers based on this aspect. Customer relationship management is vital for satisfying consumers in related product and pricing sectors. Enaifoghe [8] claims that the quality of service is primarily influenced by the degree of enthusiasm and emotional reaction.

Furthermore, objective standards are essential for consumers' intentions and emotions. In general, both directly and indirectly, emotional reactions have significant ramifications for customer intent. The general results of this study show that mediators between the impacts of quality of service on e-WOM and switching intent were consumer attitudes and emotional responses to happiness and excitement. Akintaro and Shonubi claim that a bank's corporate governance practices help explain its financial success in 2019. Improving these qualities will also help a bank's capital return. Key elements influencing corporate governance.

2.2 Digital statistics and utilization in South Africa 2025

South Africa's digital ecosystem is poised for significant advancement into 2025, leveraging the progress of prior years and solidifying its status as a dynamic centre of connection and opportunity. Due to swift developments in internet accessibility, smartphone use, and social media participation, South Africa is set for another year of vigorous growth [52]. This blog article examines the most recent digital statistics and use patterns for our nation in 2025, providing insights into how these figures influence potential for both enterprises and individuals. Gratitude is extended to Meltwater and We Are Social for their essential contributions to the data behind this investigation. The proceeding section examine the principal trends shaping South Africa's digital future.

2.3 Analysis of digital accessibility and infrastructure in South Africa 2025

As of January 2025, South Africa has 50.8 million internet users, resulting in an internet penetration rate of 78.9%. This is a substantial increase from 2024's 74.7%, with an addition of 2.6 million people (+5.4%) over the previous year – approximately 7,123 new users entering the digital domain daily [53]. Despite this promising rise, almost 13.6 million South Africans – 21.1% of the population – remain unconnected, underscoring the ongoing struggle to close the digital divide. According to [52],

“...Mobile connectivity remains predominant, with 124 million cellular mobile connections documented in 2025. This statistic, constituting 193% of the entire population of 64.4 million, highlights the ubiquity of multiple device ownership, a phenomenon driven by the emergence of eSIMs and dual-purpose connections” (personal and professional).

“...Mobile connections increased by 5.2 million (+4.4%) year-on-year, with 97.5% currently categorized as broadband (3G, 4G, or 5G), as reported by GSMA Intelligence. This resilient infrastructure facilitates improved digital experiences across.”

Internet speeds have experienced significant improvements. According to Ookla, median mobile internet download speeds attained 51.43 Mbps in early 2025, an increase of 1.72 Mbps (+3.5%) from 2024. Fixed internet speeds rose to 48.34 Mbps, reflecting a 6.0% rise over the prior year's 45.62 Mbps [52]. These improvements indicate a developing digital ecosystem, allowing businesses to offer enhanced online content and seamless user experiences.

2.4 Trends and statistics of social media usage in South Africa 2025

As of January 2025, South Africa's social media environment is flourishing, with 26.7 million active user accounts, representing 41.5% of the population. This indicates an increase of 700,000 users (+2.7%) since early 2024, maintaining the rising trend observed in prior years [53]. Among persons aged 18 and older, 59.9% engage in social media, with a nearly equal gender distribution: 48.7% female and 51.3% male. Significantly, 52.6% of the internet user demographic interacts with at least one platform, underscoring the essential significance of social media in everyday digital existence [53].

2.5 Factors influencing customers' adoption of digital banking

Numerous research studies have investigated the factors influencing consumers' acceptance of digital banking products [54–57]. Alalwan et al. (2016) found that customers' intention to use digital banking is mainly determined by perceived utility, simplicity of usage, and trust. Furthermore, demographic elements like age, education, and income impact consumers' behaviour towards digital banking [58]. Digital banking has changed consumers' channels of choice. The Technology Acceptance Model (TAM) has been utilized to examine customers' intentions to transition from conventional banking channels to digital platforms.

Research by [59] has shown that the perceived value and ease of use significantly influence consumers' propensity to move to digital channels. The convenience and accessibility of digital banking are among the most often mentioned benefits. Consumers value the ability to handle banking tasks anywhere and at any time. Studies by [60] show a favourable link between consumer happiness and the convenience of digital banking. Although digital banking offers convenience, concerns have been raised about the quality of customer care and support. Research by [61] indicates that consumers' satisfaction levels are greatly influenced by how responsive they perceive digital banking systems to be.

Security issues significantly impact customer satisfaction with digital banking. Customers' trust in digital banking services was much influenced by their view of the security policies in place [62]. Digital banking systems can offer tailored discounts and loyalty programs to enhance consumer engagement and loyalty. Studies by [63] highlighted the effectiveness of loyalty programs in retaining customers and increasing satisfaction levels.

The factors influencing digital banking enable one to better manage client connections through data analytics and tailored services. Studies by [63] highlight how tailored services enhance consumer retention and satisfaction. Alalwan et al. [64] examined the factors driving Jordanians' inclination to use mobile banking. According to the study, customers' inclination to utilise mobile banking services was much impacted by perceived usefulness, simplicity of use, trust, and perceived

security. The study emphasized the importance of robust security measures and user-centric design in encouraging consumers to adopt mobile banking.

Alalwan et al. [65] conducted a cross-cultural analysis examining the elements that impact confidence in the acceptance of mobile banking. According to the study, client trust in mobile banking was much enhanced by perceived security, privacy issues, and institutional trust. The survey highlighted the need to create a safe and reliable environment where consumers can utilise mobile banking tools. Examining mobile banking uptake in the United States [66], developed a unified theory of technology acceptance, usage, and apparent risk application.

Perceived usefulness, perceived ease of use, perceived danger, and social influence affected consumers' inclination to utilise mobile banking. The study highlighted the need to understand the potential risks associated with mobile banking to promote its acceptance. With an eye on trust, perceived risk, and privacy issues, ref. [67] examined mobile banking uptake and consumers' behavioural intention. According to the study, consumers' desire to use mobile banking was negatively influenced by perceived risk and privacy issues; trust, however, favourably influenced adoption.

The study emphasized the importance of effective risk-reduction techniques and privacy protection in fostering consumer confidence in mobile banking services. Liao et al. [68], investigated how the acceptance of mobile banking services changed about technical readiness. Technical readiness, perceived utility, and perceived simplicity of use positively impacted customers' inclination to use mobile banking. According to the study, one of the main determinants of mobile banking acceptance is the customer's openness to technology. With trust as a mediator and gender functioning as a moderating factor, [69] examined the impact of online banking on consumer satisfaction.

2.6 The role of trust in customer satisfaction in digital banking

The study revealed that trust significantly impacts customer happiness with online banking. The effect of trust on satisfaction differed depending on male and female consumers. The study emphasized the importance of trust-building strategies in enhancing client satisfaction. Ramli et al. [70], offered empirical data on mobile banking acceptance in a developing nation. Key elements determining consumers' inclination to utilise mobile banking include perceived utility, simplicity of use, and trust. The study highlighted the importance of perceived value in increasing consumer adoption in emerging countries.

Ruizalba and Izquierdo-Yusta [71] empirically investigated digital banking, customer experience, and service quality in the Spanish banking industry. According to the study, consumer experience and happiness improved in response to the quality of digital banking services. The survey highlighted the need to provide excellent digital banking solutions to enhance client satisfaction. With experience guiding the relationship, ref. [72] looked into the influence of perceived value and perceived trust on mobile banking loyalty. The study revealed that experience significantly impacted perceived value and trust, ultimately influencing mobile banking loyalty.

The study emphasized the importance of consistently providing value and fostering client loyalty in mobile banking through trust-building measures. Wang et al. [73] looked empirically at mobile banking acceptance in China. The customer's inclination to utilise mobile banking was found to be significantly influenced by

perceived risk, simplicity of use, and utility [74, 75]. The study emphasized the need for risk-reducing strategies to promote the adoption of mobile banking. Ultimately, the literature study shows that elements such as perceived utility, simplicity of use, trust, perceived security, privacy concerns, and perceived risk influence consumers' inclination to use mobile banking services.

Digital banking can enhance consumer behaviour and satisfaction by employing a user-centric design, robust security policies, and effective risk-reduction techniques. Developing trust and offering first-rate digital banking solutions also depend on fostering client loyalty and promoting the long-term adoption of mobile banking. These data allow financial institutions to maximise digital banking products and provide a more customer-centric, fulfilling banking experience.

3. Research methodology

3.1 Instrument: Survey questionnaire

This qualitative research approach uses semi-structured questionnaires to collect data from selected individuals. The study randomly assigned 20 working individuals who answered an open-ended question that elicited insightful comments and replies about the following elements influencing consumers' choices to engage in internet banking. The questionnaires were distributed via email and social media, including WhatsApp messenger. In qualitative research, a survey questionnaire is a set of open-ended questions to collect thorough, descriptive participant responses. It enables researchers to explore their ideas, feelings, and experiences on a topic in their own words rather than relying on predefined answer choices; essentially, it aims to gain deeper insights through rich, narrative data.

In this study, 20 working individuals participated in a questionnaire survey that provided insightful comments and responses regarding the following elements influencing consumers' decisions to engage in internet banking. The online qualitative survey questions do not always allow researchers to investigate or clarify participant replies. Hence, the researcher may find the data from these responses ambiguous or cryptic. While the data were less comprehensive, there was generally more of it to offset, as online surveys may gather more replies in a given amount of time than face-to-face and phone survey methods [76].

Table 2 (see **Table 2**) presents the strength of the research instrument adopted in collecting the primary data for the study from the selected participants.

Table 3 (see **Table 3**) presents the weaknesses and limitations of the research instrument adopted in collecting the primary data for the study from the selected participants. The study also utilized secondary data sources to lend credence to the primary data collected through the survey, thereby underpinning the research approach [65]. This comprised an extensive literature review, compiling and evaluating current data, conducting data analysis to derive insights, and interpreting the data to investigate the effect of digital banking on consumer behaviour and satisfaction. Using secondary data, this method aimed to provide insightful analysis of consumer preferences, behaviour, and satisfaction levels in the digital banking environment. It offers proper direction for financial institutions to enhance their digital banking offerings and increase customer satisfaction.

Strengths	Qualitative surveys can help a study early on by identifying the issues, needs, and experiences that will be explored further in an interview or focus group
	Surveys can be amended and re-run based on responses, providing an evolving and responsive research method
	Online surveys will receive typed responses, thereby reducing the need for translation by the researcher
	Online surveys can be delivered broadly across a vast population with asynchronous delivery/response

Table 2.
Qualitative research instrument: strength.

Limitations	Hand-written notes must be transcribed (time-consuming) for digital study and kept physically for reference
	Distance (or online) communication can be open to misinterpretations that cannot be corrected at the time
	Questions can be leading/misleading, eliciting answers not core to the research subject. Researchers must aim to write a neutral question which does not give away the researcher's expectations
	Even with transcribed/digital responses, an analysis can be long and detailed, though not as much as an interview
	Surveys may be left incomplete if performed online or taken by research assistants who are not well-trained to give the study/structured interview
	Narrow sampling may skew the survey results [Nielsen Norman 77]

Source: Author's own compilation.

Table 3.
Qualitative research instrument: limitation.

3.2 Data presentation

The study presents and analyses the data thematically based on adopting digital banking and customer satisfaction. The rise in the popularity of digital banking has changed consumer interaction with financial institutions. The main objectives of this part of the research study are to examine the adoption trends of digital banking among various client categories, investigate the reasons behind its acceptance, and comprehend the development rate and adoption patterns over time.

3.3 Qualitative data analysis

Research question: What influences your adoption of digital banking?

The participants were asked what influences their adoption of digital banking and their responses regarding the factors affecting the adoption of digital banking in South Africa are presented below in **Table 4**:

The above responses from the participants reflect various perspectives on the growth rate and patterns of digital banking adoption, highlighting technological advancements, demographic trends, and the impact of a global pandemic. As [67],

Participants	Response
P01	"I find digital banking convenient because I can access my account anytime and anywhere."
P02	"Security concerns are a major factor for me. I need to be sure my money is safe."
P03	"The user interface of the banking app is critical. If it's not user-friendly, I won't use it."
P04	"I adopted digital banking because it saves me time. No more waiting in long queues at the bank."
P05	"The availability of customer support in case of issues is crucial for me."
P06	"I prefer digital banking because it offers better interest rates and lower fees."
P07	"The ability to perform transactions quickly and efficiently is a key factor for me."
P08	"I was influenced by my friends and family who were already using digital banking."
P09	"Promotions and incentives offered by the bank encouraged me to switch to digital banking."
P10	"I appreciate the transparency and real-time updates on my account balance and transactions."
P11	"The integration of digital banking with other financial services, like investments, is a big plus."
P12	"I adopted digital banking due to the ease of managing multiple accounts in one place."
P13	"The bank's reputation and trustworthiness played a significant role in my decision."
P14	"I like the innovative features, such as budgeting tools and spending analysis, offered by digital banking."
P15	"The ability to easily transfer money to friends and family is very important to me."
P16	"I was hesitant at first, but the bank's educational resources helped me understand how to use digital banking."
P17	"The speed of processing transactions, especially during emergencies, is a key factor for me."
P18	"I adopted digital banking because it reduces the need for physical cash, which I find safer."
P19	"The ability to set up automatic payments and reminders is very convenient for managing my finances."
P20	"I appreciate the environmental benefits of digital banking, such as reduced paper usage."

Source: Author's own compilation.

Table 4.
The influences of digital banking adoption.

indicated, digital banking refers to the increasing use of online and mobile platforms, applications, and digital tools for managing financial services, including banking transactions, payments, and access to financial goods. According to the findings, digital banking has markedly improved client happiness by providing ease, accessibility, and efficiency. Principal elements contributing to this pleasure include usability, round-the-clock accessibility, enhanced security, customized services, expedited transactions, cost efficiency, and innovative features [8, 66].

Research question: What is the Growth Rate and Patterns of Digital Banking Adoption?

The transition to digital banking has increased client satisfaction by enhancing convenience, security, and personalisation (See **Table 5**). Driven by convenience, cost-effectiveness, and increased internet access, digital banking adoption is rapidly rising worldwide; emerging regions, such as the Asia-Pacific, lead in fintech and e-wallet use

Participants	Responses
P01	<i>"The growth rate of digital banking has been phenomenal, especially post-pandemic. The convenience and accessibility it offers are unmatched."</i>
P02	<i>"I believe the adoption of digital banking is driven by technological advancements like AI and blockchain, which enhance security and user experience."</i>
P03	<i>"Millennials and Gen Z are leading the charge in digital banking adoption. Their preference for mobile banking apps is reshaping the industry."</i>
P04	<i>"The global digital banking market is projected to grow at a CAGR of 8.5% from 2021 to 2026. This highlights the increasing reliance on digital financial services."</i>
P05	<i>"COVID-19 significantly accelerated digital banking adoption. Many consumers turned to digital channels for their banking needs during lockdowns."</i>
P06	<i>"Neobanks are gaining popularity among younger generations due to their tech-savvy solutions and lack of traditional branch networks."</i>
P07	<i>"Embedded finance is an innovative trend where financial services are integrated within non-financial platforms, creating a seamless user experience."</i>
P08	<i>"Higher income individuals are more likely to use digital banking, driven by greater access to technology and financial literacy."</i>
P09	<i>"Regions like North America and Europe lead in digital banking adoption rates, while Africa and South America are experiencing rapid growth."</i>
P10	<i>"AI-powered chatbots and virtual assistants offer 24/7 customer support, making banking more accessible and efficient."</i>
P11	<i>"The perceived usefulness of digital banking is a key factor in promoting its adoption in emerging markets."</i>
P12	<i>"Cloud computing complements AI, offering scalable, cost-effective data storage options for banks."</i>
P13	<i>"Digital banking adoption rates have surged in recent years, driven by technological advancements and changing consumer behaviors."</i>
P14	<i>"The integration of AI presents a \$199 billion cost-saving opportunity for banks globally."</i>
P15	<i>"Efforts to increase digital inclusion are helping bridge the gap, making digital banking accessible to a broader audience."</i>
P16	<i>"The rise of digital banking is a testimony to technological advancement and changing consumer preferences."</i>
P17	<i>"Digital banking is not just a convenience but a necessity in today's fast-paced world."</i>
P18	<i>"The shift towards cloud computing allows banks to manage extensive data efficiently, fostering a responsive and flexible banking environment."</i>
P19	<i>"Technological innovations like biometric authentication and blockchain have played a significant role in the growth of digital banking."</i>
P20	<i>"Consumers have become accustomed to the convenience of digital banking, and many are unlikely to return to traditional banking methods."</i>
<i>Source: Author's own compilation.</i>	

Table 5.
The growth rate and patterns of digital banking adoption.

[43]. This change is altering consumer behaviour and financial management, which is why banks are investing in digital technology and improving their online products. Digital banking offers consumers a range of diverse, simple, and accessible services, including account management, mobile banking, online payments, and tailored financial tools, while prioritizing security and customer satisfaction.

4. Discussion of research findings

4.1 Factors influencing the adoption of digital banking

The section below presents the factors influencing the adoption of digital banking among different customer segments. Findings from the data collected through the survey show that numerous factors influence the adoption of digital banking, which vary across various customer segments. Some of the key factors include the following;

4.2 The adoption of digital banking.

Table 6 (see **Table 6**) indicates that the consumers who are most inclined to embracing digital banking services are more tech-savvy and easily use digital platforms with the adoption of digital banking. The findings show that in banking, digital adoption integrates and utilises digital technology and solutions to increase overall efficiency, simplify processes, and enhance client experiences, ultimately improving the banking sector. In line with [4, 6], the adoption of digital channels and technologies, such as mobile banking applications, online account management systems, customer service chatbots, and digital payment solutions, is a key factor influencing digital banking [7–9]. Findings show that banks can provide consumers with easy and accessible financial services, offer self-service alternatives, and offer

Technological literacy	The findings show that in banking adoption of digital banking depends much on the degree of technological knowledge. Consumers most inclined to embrace digital banking services are more tech-savvy and easily utilizing digital platforms.
Convenience and accessibility	Customers looking for a flawless banking experience are drawn to digital banking because of its conveniences – 24/7 availability, simple access to account information, and speedy transaction processing.
Security and trust	The adoption rates of digital banking platforms depend heavily on perceived security and dependability. Consumers must be sure their personal and financial data is protected.
User experience	Encouragement of digital banking acceptance depends mainly on a well-designed and user-friendly interface. If digital banking systems are user-friendly and accessible, consumers will be more inclined to accept them.
Service offerings	Adoption rates also depend on the spectrum of services and features provided by digital banking systems. Consumers want varied and all-encompassing services that fit their budgets.
Demographic factors	Important demographic determinants of digital banking acceptance include age, income, education, and employment. Often referred to as “digital natives,” younger, more educated consumers seem to embrace Internet banking more quickly.
Regulatory environment	The laws controlling digital financial services could either promote or discourage adoption. Clear, encouraging rules help consumers feel more confident, promoting better adoption rates.

Source: Author's own compilation.

Table 6.
Adoption of digital banking.

tailored experiences based on data-driven insights by adopting digital technologies. In line with [1], digital adoption in banking is a transformative journey to meet the shifting expectations of tech-savvy consumers, inspire creativity, and help banks stay competitive in the rapidly evolving financial landscape.

4.3 Patterns of digital banking adoption

The research report examines the rising rate and trends of digital banking acceptance over time to identify its direction and relevance in the financial sector. Analysing past data and patterns helps the researcher understand the speed and extent of adoption.

Table 7 (see **Table 7**) shows the patterns of digital banking adoption.

The study indicates that the use of digital banking services (DBS) has transformed the traditional concept of conventional banking in the rapidly evolving modern world. Contemporary artificial intelligence-incorporated technology made it feasible. This was done to satisfy consumers’ ever-rising needs by utilising more convenient and time-saving technology applications [10, 12, 44]. This theme identifies and evaluates the elements influencing the acceptance of digital banking solutions. The study report compares adoption rates across various areas or among different demographic categories to understand the impact of digital banking adoption.

4.4 Customer behaviour in digital banking

With unmatched accessibility and ease, the introduction of digital banking has transformed consumer interaction with financial institutions. In line with [3], the findings noted that with an eye on transactional behaviour, digital engagement [56], and the effects of user experience and interface design on customer behaviour, this research study explores customer behaviour in the digital banking environment.

Table 8 (see **Table 8**) encapsulates essential behavioural patterns and preferences that impact customer adoption of digital banking. It emphasises simplicity, security, and user-friendliness as key motivators, while confidence in the bank’s reputation and the availability of customer assistance are crucial for maintaining engagement. The research indicates age disparities, with younger cohorts exhibiting elevated adoption rates attributed to technical proficiency and a

Early adoption phase	The study identified the first phase of digital banking adoption, characterized by early adopters’ enthusiastic reception of the technology. Understanding the latter trends depends on knowing the reasons for the difficulties and demands experienced during this era.
Accelerated growth	The study draws attention to periods of rapid adoption of digital banking that correspond with notable technology developments, higher smartphone penetration, or consumer behaviour modification.
Sustained adoption	Examining long-term patterns helps one understand the continuous acceptance of digital banking. Finding the elements behind ongoing adoption will inform plans.

Source: Author’s own compilation.

Table 7.
Patterns of digital banking.

Regional disparities	The report can highlight regional disparities in digital banking adoption, where some regions exhibit higher rates than others. Investigating the causes of these differences will enable one to customise region-specific plans.
Demographic variation	Comparing adoption rates across different demographic groups helps identify trends in age, income, education, and employment. Knowing these variances helps one provide focused solutions for the demands of various client groups.
Urban vs. rural adoption	The study may also examine the differences in adoption rates between urban and rural areas, highlighting the challenges and opportunities in extending digital banking services to underdeveloped regions.

Source: Author's own compilation.

Table 8.
Customer behaviour to digital banking.

desire for mobile solutions. Moreover, financial incentives such as reduced fees and enhanced interest rates, in conjunction with new features like budgeting tools, foster favourable client perceptions. The table demonstrates how a synergy of functional advantages, trust, and technical accessibility influences customer behaviour about digital banking.

4.5 Transactional behaviour

This part examines the kinds and frequency of online transactions. The results show that digital banking systems enable consumers to handle various transactions easily and quickly. Analysing transactional activity helps the research study understand consumer preferences and patterns while using digital channels for banking operations [13, 56].

This table (As seen in **Table 9**) illustrates trends in customer engagement with digital banking for transactional activities. It generally encompasses information on the frequency and categories of transactions executed, including fund transfers, bill payments, and mobile top-ups. Research frequently indicates that consumers choose digital channels for regular and time-critical transactions because of their rapidity, convenience, and round-the-clock accessibility. Elevated transaction volumes on mobile and internet platforms signify a transition from conventional branch-based

Frequency of transactions	The report may examine how often people use digital banking systems. This might include bill payments, checking account balances, financial transfers, and making online purchases.
Types of transactions	Depending on their complexity, scope, and intent, the research could classify transactions. For example, one can better understand consumer preferences by contrasting the frequency of small daily transactions with more significant occasional ones.
Seasonal and behavioural patterns	The study could find seasonal or behavioural trends through time-series analysis of transactional behaviour, including more online buying around holidays.

Source: Author's own compilation.

Table 9.
Transactional behaviour.

banking. The table may also reveal demographic or income disparities, indicating that younger and higher-income consumers engage in digital transactions more frequently. The data indicates an increasing dependence on digital banking for routine financial transactions, underscoring its contribution to improved customer satisfaction and operational efficiency.

4.6 Digital engagement

This section examines consumer interaction with digital banking platforms and uses several features (see **Table 10**). Ref. [20, 5] noted that many digital banking system tools and features help consumers properly manage their money. How consumers interact with these elements determines their preferences and needs.

4.7 The experience and interface design of the user

The study looked at customer behaviour regarding the user interface and experience. The results show that in digital banking, client behaviour is strongly influenced by interface design and user experience [55] (See **Table 11**). A well-designed, simple interface may raise customer satisfaction and inspire ongoing involvement.

Feature utilization	The study report may examine which particular qualities consumers most often use. For example, it may examine the popularity of real-time transaction notifications, budgeting tools, or mobile check deposits.
Customer segmentation	The research could spot different consumer categories based on their digital interaction behaviour. By allowing financial institutions to customise their products and services, this segmentation helps them better satisfy consumer demands.
Multi-channel engagement	Analysing consumer interactions across multiple digital platforms – such as mobile applications, online browsers, or social media – enables a better understanding of their preferred communication style.

Source: Author’s own compilation.

Table 10.
Digital engagement.

Usability and navigation	The study assesses how easily one can use and navigate digital financial systems. Understanding consumer preferences for user interfaces helps guide subsequent design improvements
Mobile vs. web	By comparing user experiences on mobile applications and web-based platforms, one may identify which channel consumers prefer and how this inclination affects their interaction with digital banking services
Customer feedback	Using surveys or feedback systems, including consumer comments on user experience, one may gain an essential understanding of pain spots and areas for development

Source: Author’s own compilation.

Table 11.
User experience and interface design.

4.8 Services and features

This section examined the most sought-after digital banking services and features to gain a better understanding of consumers' needs. Modern consumers can find a wide range of services and features on digital banking platforms to meet their needs [14, 21, 54]. Finding the most demanded features and services helps one understand consumer expectations and priorities (See **Table 12**).

4.9 Channel preferences

In line with [45], it is important to examine consumer preferences for particular digital channels – such as mobile apps against web browsers – as consumers interact with digital banking across several channels, and their choices of specific platforms might affect their happiness and involvement.

This table (**Table 13**) delineates the favoured channels via which clients engage with digital banking services, including mobile applications, online banking, automated teller machines, and in-person branch visits. The research indicates a significant preference for mobile banking applications, particularly among younger groups, owing to their convenience and user-friendliness. Internet banking continues to be favoured for intricate transactions, whilst ATMs retain their significance for cash withdrawals. Branch visits have markedly decreased, indicating a transition to digital-first interactions. These choices underscore the necessity of optimising mobile and internet platforms to align with increasing client expectations and augment happiness.

Online banking	Examining the popularity of online banking tools like bill payment management, financial transfers, and checking account balancing
Mobile payments	Investigating the acceptance and use of mobile payment solutions, including contactless payments and mobile wallets
Personal finance management tools	Evaluating the application of financial planning tools, expenditure monitors, and budgeting instruments
P2P transfers	Examining peer-to-peer money transfer frequency and volume via digital banking systems
Digital security features	Examine how essential security elements, such as biometric login and two-factor authentication, influence consumer preferences

Source: Author's own compilation.

Table 12.
Services and features.

Mobile app vs. web browser	This examined the percentage of consumers who would instead engage in banking operations using mobile applications rather than online browsers. This study can help one understand any channel's ease and user experience
Multi-channel engagement	Knowing how consumers choose and use several digital channels for various banking purposes helps one to understand them better
Accessibility and device compatibility	Analysing if consumers choose particular channels depending on device compatibility – utilizing a web browser for more thorough financial management and a mobile app for rapid transactions

Table 13.
Channel preferences.

4.10 Personalization

In this section, the study examines the role of personalized recommendations and offerings in shaping customer preferences. In line with the research findings, ref. [59] indicated that increasing client involvement and happiness depends heavily on personalization. The study believes that customizing services to meet specific consumer demands in digital banking relies on an understanding of the impact of personalized suggestions and offers (See **Table 14**).

The banking industry and technology have transformed many facets of our lives. This corresponds to [47] that convenience and efficiency make online banking services a natural component of our everyday life. These services rely on technical developments to enable banks and consumers to exchange information effectively. These online banking services are made possible mainly by the Internet, with its great range of communication and information tools [48,]. The Internet has changed the banking and financial sectors, particularly in terms of basic goods and services. The conception of these items, suggested use, delivery, and consumption have changed significantly.

4.11 Effect of online banking in consumer behaviour

The Internet has become a priceless tool, driving development, encouraging creativity, and increasing competition in the banking industry. Changes in distribution channels have fostered the development of banking technology. From the first ATMs, phone banking, telebanking, and PC banking, we have arrived at the age of online banking. Online banking lets companies and people use banking services from their workplaces or homes. Easy access and consistent daily financial transaction processing have helped banks attract a wide spectrum of commercial and retail clients.

Customer happiness becomes increasingly important as technology develops and determines the viability of a bank. 78 defines electronic banking as using computers and telecommunications to execute banking operations without in-person contact. Its other services are automated payroll distribution and retail buying [79]. Higher customer satisfaction results from the efficiency and simplicity of electronic banking [80]. In electronic banking, consumer satisfaction is much enhanced by speed, efficiency, and security [81]. Improving customer satisfaction mostly depends on measuring service quality and always refining the process [82].

Tailored product recommendations	It assesses how tailored suggestions for products and services affect consumer choice
Customized notifications	Evaluating how tailored alerts affect consumer interaction and behaviour
Segment-specific offerings	Evaluating the success of segment-specific products, in which digital banking solutions are catered to specific client categories
Privacy and consent	Investigating consumer opinions on data privacy and the degree of permission needed for tailored services

Source: Author's own compilation.

Table 14.
Personalized services.

To reduce mistakes in electronic banking, [49] argued that digital banking helps to provide time savings, which benefits consumers. This helps consumers, while also allowing the banking industry to lower expenses and increase overall efficiency [83]. Kumar [84] suggests that computerized banking can be designed to offer individualized consumer services, thereby improving satisfaction. Checking bank accounts and making transactions from anywhere at any time helps consumers save time and enhances service delivery through this capability [20, 85]. Moreover, the provision of 24/7 services enhances client satisfaction by allowing them to access financial services at their convenience [85].

The advantages of electronic banking – such as the possibility of making transactions without a physical presence – have driven its dependence [86]. Still, it's crucial to allay security worries about mobile banking. Strong security mechanisms should be built within the system to safeguard consumer data [87]. Electronic banking has significantly enhanced consumer satisfaction by offering convenience, efficiency, and personalized services. Customer satisfaction has also been enhanced by fewer mistakes and the availability of financial services anywhere, anytime. Still, cybersecurity must be prioritized if consumer data is to remain protected. By addressing these elements, banks can continue to raise customer satisfaction and meet the evolving expectations of their clients.

4.12 Customer satisfaction in digital banking

The viability of any financial service – including digital banking – depends on customer happiness. This section of the research paper compares customer satisfaction in digital banking with that of conventional banking services, measuring overall customer satisfaction with digital banking experiences. It identifies the primary factors influencing customer satisfaction in the digital banking environment. The banking sector has quickly adopted Internet banking as a practical and profitable instrument to produce client value [79]. One of the well-liked offerings that conventional banks supply is to provide internet customers with dependable and faster solutions. As computer technology continues to develop rapidly as a business tool, Internet banking can be utilized to attract more clients to handle financial transactions with associated institutions.

The biggest issue Internet banking presents for providers is that many banks' clients are not eager to use the available services [63]. This results from the services provided by Internet banking still not meeting their needs. The results indicate that maintaining competitive advantages for banks heavily depends on customer satisfaction. Therefore, this research examines the factors that influence consumer satisfaction with Internet banking. Service quality, online design and content, security and privacy, convenience, and speed are the five key elements that affect client satisfaction with Internet banking [50].

According to this study, client satisfaction with Internet banking is directly related to online design and content, ease of use, and speed. Alternatively, according to the findings of this study, client satisfaction with Internet banking is primarily influenced by site design and content, ease of use, and speed. In digital banking, consumer satisfaction depends on characteristics such as ease, security, customisation, and the overall user experience; studies reveal that these elements significantly affect customer loyalty and satisfaction.

4.13 Services to digital banking

Digital innovative banks are evolving rapidly and have achieved significant societal acceptance and substantial developmental outcomes. Machasio [88] claims that the evolution of the Internet has dramatically challenged established banks and helped online finance flourish. This has also driven conventional banks to use the Internet to increase service efficiency. Given the great efficiency with which Internet information is shared, traditional banks must leverage its benefits to raise the quality of services. Simultaneously, from the standpoint of commercial bank business transformation, [89] Lien et al. (2020) explored how information technology affected conventional commercial banking operations.

Consequently, they believe that utilising information technology to facilitate the digital transformation of conventional commercial banks is suitable for reducing expenses and enhancing efficiency. They also said that the Internet's electronic information enables digital transformation. Dang et al. [90] developed an assessment methodology for the digital transformation of commercial bank outlets. The model assesses the effect of digital transformation of conventional commercial bank outlets using a thorough assessment approach. Furthermore, the model can efficiently identify issues developing during the digital service transformation of commercial bank smart outlets.

Penney et al. [91], claim that the convenience of utilising electronic statements drives individuals to transition from paper to electronic ones, rather than the detrimental effect of paper on the environment. The survey also revealed that the traceability of electronic statements was key to consumers' utilisation of mobile apps and online banking platforms to view online declarations. In line with [24, 92] Ismail and Alawamleh (2017) claim that consumers want service providers to offer the most significant labour- and time-saving solutions. If online banking is available at any time, if waiting in line is avoided, the amount of time saved compared to traditional banking, or the simplicity of the login process, convenience may be assessed in several different ways.

The statistical research indicates that the properties of digital banking, including time efficiency, user-friendliness, and flexibility regarding location and timing, result in notable variations in consumer satisfaction levels. The findings indicate that the risks associated with personal and financial data security, inadequate understanding of digital banking, and the potential for fraud contribute to notable disparities in consumer satisfaction levels. Ultimately, the findings demonstrate that the anticipated outcomes of banking service digitization, including an increase in digital goods and services as well as new functions, result in notable disparities in customer satisfaction levels.

4.14 Implications of the study

This study enhances the existing literature on the subject in several ways. Initially, we contribute to the body of knowledge on digital banking services. It also engages in research to comprehend client satisfaction with digital banking services. Furthermore, we thoroughly analysed the hazards linked to digital banking that result in substantial variations in consumer satisfaction levels. Ultimately, we contribute to the study of customers' expectations of digital banking and their impact on customer happiness. This research has several practical contributions. To enhance client happiness, it recommends how banks can cultivate trust and establish secure processes in digital banking.

It was also noted how bankers can apprise consumers of various opportunities and furnish needed help. Digital infrastructure is a challenge, particularly in developing nations; yet, it is critically important since cost efficiency, time savings, simplicity, and flexibility contribute to enhanced consumer satisfaction. The probable ramifications of the fast expansion of digital banking services on consumer behaviour and satisfaction, emphasizing main stakeholders including bank executives, governmental entities, and policymakers:

1. Bank managers consequences:

- Operational Efficiency: Enhanced dependence on digital platforms diminishes the necessity of physical branches, reducing overhead expenses.
- Customer Insights: Improved data analytics from digital interactions provides profound insights into customer preferences and behaviour.
- Service Innovation: The imperative to always develop and provide seamless, user-centric digital experiences.
- Risk Management: Emerging cybersecurity threats and fraud risks necessitate revised risk assessment and mitigation measures.
- Personnel Modifications: Transition in labour requirements – from conventional banking positions to technologically proficient and customer service jobs.

Strategic Considerations:

- Allocate resources to artificial intelligence and machine learning for tailored services.
- Enhance employee competencies to effectively utilize digital technologies and facilitate online consumer engagement.

2. Government entities consequences:

- Digital Inclusion: It is imperative to provide fair access to digital banking, particularly in rural or underdeveloped regions.
- Infrastructure Development: Heightened need for resilient digital infrastructure (e.g., internet access, mobile networks).
- Consumer Protection: Enhanced obligation to safeguard customers against digital fraud and uphold data privacy.
- Economic Surveillance: Enhanced monitoring of financial activities can facilitate economic planning and tax adherence.

Strategic Factors:

- Advocate for digital literacy initiatives.

- Partner with financial institutions to enhance digital infrastructure.

3. Policymakers consequences:

- Regulatory Frameworks: Rules pertaining to digital banking, fintech collaborations, and data governance must be revised or established.
- Financial Stability: Assess the systemic risks of digital-only banks and fintech disruptors.
- Balancing Innovation and Regulation: Promote innovation while safeguarding consumer safety and guaranteeing market equity.
- Cross-Border Transactions: Address issues about transnational digital banking and money laundering.

Strategic Considerations

- Create flexible regulatory sandboxes for financial experimentation.
- Harmonize digital banking regulations across regions.

5. Conclusion

This research aims to ascertain the impact of customer satisfaction in online banking as a mediator in interactions. Government-forced lockdowns and consumer unwillingness to physically visit bank locations have driven the change from conventional banking to Internet services. However, this survey has certain limitations, as it focuses on customer happiness, satisfaction, and service quality.

More studies are required to determine the impact of consumer pleasure or discontent on the switching costs for banks offering online banking and the switching intentions of consumers of these institutions. Future research should also investigate the link between the variety of online banking consumers and problems with electronic payments, including money transfers, security, and bill payments.

To survive in the digital banking age, financial institutions must prioritise client satisfaction, adapt their customer-centric strategy, and implement robust security measures. Banks can develop enduring client connections, increase customer satisfaction, and inspire confidence in their digital banking services by enhancing the user experience, customising services, and prioritising data security and transparency. Strategically applying these suggestions will help ensure banks' success in the evolving digital banking landscape by fostering better client behaviour and satisfaction.

6. Recommendation

- Given the negligible value achieved in controlling and enjoying internet banking services banks offer, it is strongly recommended that banks

critically examine these variables as they can impact profitability and customer switching intent.

- Additionally, it is advised that banks invest in understanding the needs of Internet banking customers and make every effort to meet their requirements related to the services provided by Internet banking.
- There is a need to educate most of the banking population about Internet banking.

7. Further research

- Further research can be conducted in the banking sector to compare traditional and Internet banking customers regarding online service quality, loyalty, and the reciprocal effect of online satisfaction on their relationships.
- Using a representative sample, studies could explore the relationship between e-service quality and e-loyalty among online banking customers. Brand awareness through mobile banking should be reinforced, considering the increasing number of mobile users today.
- Banks should collaborate with network advertising companies to create captivating advertising campaigns that capture consumer attention.
- Many respondents who completed the questionnaires declined or were unable to answer due to a lack of knowledge or a minimal understanding of Internet banking services.

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Chapter 3

Digital Finance and Bank Stability in Developing Economies: The Fortifying Role of Internet Penetration

Walid Bakry, Peter John Kavalimthara and Sajan Cyril

Abstract

With the accelerating pace of the digital revolution across economies, its impact on the soundness of banks is of significant interest to researchers and policy makers. Understanding this relationship in the context of developing economies, characterized by fragile financial systems and weak regulatory controls, is particularly important to formulate sustainable economic growth strategies and financial inclusion. This chapter investigates the effect of digital finance on bank stability in 35 developing countries, focusing on their nonlinear nexus and the moderating role of internet penetration. Using two-step IV-GMM estimation across multiple model specifications, we find evidence of a U-shaped relationship – digital finance initially weakens bank stability, but beyond a threshold, it supports stability. Crucially, internet penetration moderates this relationship: the U-shaped curve flattens and shifts upward, signifying better and sustained stability irrespective of the digital finance level. These findings imply that while growth in digital finance is vital to support economic and social equity, strengthening a country's information technology infrastructure and policies to boost internet penetration is a precondition for sustainable financial inclusion. The chapter discusses policy implications for developing countries, showing that internet access amplifies the benefits of digital finance only when embedded within a broader ecosystem of institutional readiness and risk management.

Keywords: banking stability, digital finance, developing countries, financial inclusion, internet penetration, mobile money transactions

1. Introduction

Digital finance has emerged as a transformative force in the financial landscape of developing countries. Digital finance involves delivering financial services to customers through mobile phones and other digital platforms. It also serves as a foundation for enabling the fast-evolving application of artificial intelligence (AI) in banking operations. These services include mobile banking, digital currency

transactions, and a range of more complex transactions supporting economic growth. These services enhance efficiency and accessibility among users. Providing financial services to low-income citizens is an important imperative for developing countries. However, the inefficiencies and high costs of delivering these services by expanding traditional channels, such as bank branch networks, inhibit the financial inclusion of less privileged people, especially in rural areas. Digital finance provides an attractive alternative channel to address this challenge [1].

It is of great practical significance to understand whether digital finance (also called digital financial inclusion, typically measured by the volume of digital finance transactions) hampers or supports the stability of banking systems. To ensure solvency, banking systems must maintain resilience capable of absorbing financial shocks, including abrupt changes in fiscal policy, market prices, liquidity, and credit conditions. Key indicators of stability in the banking system, such as capital adequacy, asset quality, and earnings, remain central to evaluating this resilience. Bank Z-Score, which measures the probability of default of a country's commercial banking system, is widely used as a proxy for banking system stability [2]. It is argued that the digital economy, due to its role as a universal intermediary, can cause a disproportionate impact of systemic risks on society [3]. Thus, to realize and sustain the benefits of digital finance, policymakers and banks must have a sound understanding of the downside risks of digitization on the financial system and how to mitigate potential challenges to financial inclusion.

Literature has increasingly explored the nexus between digital financial inclusion and bank stability. Recent empirical studies have employed advanced econometric methodologies, including dynamic panel data estimations and generalized method of moments (GMM), to evaluate this relationship across various economic contexts, including members of the European Union [4], Sub-Saharan African nations [5, 6], and emerging Asian countries [7, 8].

Empirical evidence on the impact of digital finance on bank stability is mixed. Some studies suggest a positive linear relationship [9–12], whereas some others find a negative relationship [13–16]. Anton and Nucu [17], based on data from developed and developing countries, offer a significant contribution to this discourse by finding a U-shaped relationship, whereby financial inclusion initially exerts a negative influence on bank stability, which becomes positive after surpassing a critical threshold. This suggests that digital finance has a detrimental effect on bank stability until a certain point, after which the banking system's resilience is enhanced.

Despite the insights from empirical research discussed above, a significant knowledge gap remains in understanding the nexus between digital finance and the soundness of the banking system, in particular the effect of factors such as a country's internet penetration level on undertaking digital banking transactions. In this study, we explore and test for linear and nonlinear relationships and the moderating role of internet penetration on the linkage between digital finance and bank stability using data from a panel of 35 developing countries.

The contributions of this study are discussed below. Given the lack of academic consensus on how digital finance affects bank stability, we extend the literature by exploring the existence of either linear or nonlinear relationships between digital finance and bank soundness using recent data from a panel of 35 developing countries. Importantly, we investigate how a country's internet penetration, that is, the proportion of the population using the internet, shapes the association between digital finance and banking system stability. To the best of our knowledge, no such research

has been undertaken so far. Yen and Dao [16] investigated the role of bank-specific factors, such as size, in moderating the linkage between digital finance and bank stability. Anton and Nucu [17] emphasize the importance of understanding the role of any factor that moderates the cross-country nonlinear relationship between digital finance and banking soundness. We argue that a country's internet penetration is one such important factor. A country's internet penetration, typically measured by the percentage of a country's population using the internet, is an indicator of the maturity, robustness, and capabilities of its digital infrastructure. Therefore, insights into the interaction of internet penetration with the relationship between digital finance and bank stability can assist policy makers in developing prudent strategies to reap the sustainable benefits of financial inclusion. Finally, we base our investigation exclusively on a panel of developing countries, which exhibit a major deviation in internet penetration from developed countries. For example, as of 2021, only 57% of people in the developing world have access to the internet, whereas 90% of those in the developed world have this access [18]. There is also a material digital divide between countries within the developing world. Boosting financial inclusion and equitable economic growth through the digitization of financial transactions without hampering the soundness of the banking system is an important imperative for policy makers in developing countries. To support this national objective of inclusive growth, it is crucial to understand how digital finance impacts the financial health of banks in the specific technological context of these countries.

2. Literature review

The impact of digital finance on the financial strength of banks has been a subject of significant research interest. Theoretical arguments have been advanced to support either a positive or negative relationship between the two variables. The systems theory of financial inclusion postulates that digital financial inclusion relies on existing systems such as financial or banking systems and social structures [19]. Therefore, these existing systems benefit from rising digital financial inclusion. Using institutional theory and a detailed review of theoretical studies, Damane and Sin [11] argue that digital finance can positively affect financial stability by diversifying the funding sources of financial institutions, raising affordable and stable deposits from retail customers, reducing their marginal costs, and providing banking services in a more inclusive financial sector [10, 11, 20]. Supporting this, Čihák et al. [12] argue that during periods of systemic distress, low-income clients provide a stable deposit base to banks when other sources of funding dry up. Khan provides three channels through which financial inclusion contributes to banks' stability: strengthening the bank deposit base, boosting the efficiency of financial intermediation by increasing the participation of the population in the formal financial system, and diversifying the asset base of banks, thereby making the economy more resilient to systemic shocks [21].

However, there is no academic consensus on the positive impact of digital financial inclusion on bank stability. Contrary to the theoretical arguments discussed above, extreme financial inclusion theory explains why financial inclusion can cause instability in banks [11]. The theory posits that when the population is given access to the formal financial system without consideration of their income or level of risk, it may compromise the integrity of banks. Sahay [22] argues that rapid

growth in credit to new borrowers may result in a rise in non-performing loans, threatening the financial soundness of banks. Extensive use of credit by individuals can trigger tail risks and make financial inclusion more correlated with unexpected losses in the financial system [23].

Empirical investigation of the linkage between digital financial inclusion and the robustness of the banking system has also revealed divergent findings. Evaluating access to bank deposits prior to the 2008 Global Financial Crisis and the dynamics of bank deposit growth during the crisis, Han and Melecky [9] show that broader access to bank deposits helps enhance the resilience of banks' deposit funding base during periods of financial stress. Some recent studies, particularly in the context of China, focus on commercial banks and examine how digital transformation has contributed to improvements in financial performance. Using panel data from 2010 to 2021 on 187 commercial banks in China, Liang et al. [24] find that digital finance improves the banks' operational efficiency, profitability, and risk-taking capacity. Fernando and Disanayaka found a significant link between digital finance and enhanced banking stability in developing countries, emphasizing the need for improved financial services [25]. Li et al. [26], in their cross-country analysis across 31 Asian countries, found compelling evidence that greater financial inclusion enhances bank stability by expanding the depositor base and facilitating more diversified lending practices. Similarly, Neaime and Gaysset [27] conducted research across the Middle East and North Africa (MENA) regions and demonstrated evidence of a positive relationship between financial inclusion and bank stability. A study by Banna and Alam, using data relating to several mobile money agent outlets, mobile money accounts, and mobile and internet banking transactions, suggests that digital financial inclusion increases the stability of banking in the ASEAN countries [28].

Differing from the above evidence, Čihák et al. [12] find evidence that, on average, financial inclusion and stability correlate negatively. Banna [13] reports that the relationship between digital finance and the stability of Islamic banks is either insignificant or negative. There is evidence that the volume of credit provided by fintech lenders adversely affects bank stability and market power [14]. Kasri et al. [15] find no significant causality between digital payment and Islamic banking stability in Indonesia. Vives [29] argues that increased usage of digital finance technology unsettles banking stability due to risks such as data theft, payment system disruption, and an increase in nonperforming loans due to easy access to credit. In view of the divergent evidence on the positive and negative linkage between financial inclusion, we propose to test the following hypothesis:

H1: There is a linear nexus between digital finance and bank stability.

While several studies have explored a possible linear association between financial inclusion and the soundness of banks, the literature shows only very limited research on exploring nonlinear relationships between the two. A study based on bank-level data from eight ASEAN countries reveals that financial inclusion above a threshold increases bank stability, whereas countries with financial inclusion below the threshold experience a decrease in stability [16]. Another study using country-level data from 81 developed and developing economies has shown a similar result, indicating a U-shaped relationship between digital financial inclusion and the soundness of the banking system [6].

However, no empirical investigation of country-specific factors that may contribute to the nonlinearity was undertaken in the two studies mentioned above. Given evidence from numerous studies showing linear relationships and limited recent evidence on a nonlinear relationship between digital finance and the stability of banks, we formulate the following hypothesis specifically in the context of developing countries.

H2: There is a nonlinear association between digital finance and bank stability.

Studies to understand factors that may moderate the association of financial inclusion with the financial soundness of banks have been scant. There is evidence that the correlations between financial inclusion and bank stability vary systematically across country contexts, individuals, firms, and financial instruments [12]. For example, regions pushing for faster financial inclusion can witness increases in lending and loan default rates [30]. Investigation based on bank-level data from 78 developing and developed countries reveals that only after a certain level of institutional quality does financial inclusion have a significant and positive impact on bank stability [31]. Ketterer [32] argues that digital financial inclusion can be deterred by poor quality and high cost of digital connectivity for individuals and businesses. This is due to deficiencies in the regulatory framework and insufficient infrastructure, which need to be resolved.

To the best of our knowledge, the role of a country's internet penetration in shaping the nexus between digital finance and bank stability has not been empirically investigated. However, a few studies have explored the role of digitization in the financial soundness of banks. Antwi and Kong [33] find that mobile phone subscriptions, as a proxy for digital finance technology, have a negative impact on bank stability in emerging economies, whereas internet usage, as a proxy, reveals a positive impact. Another study involving financial institutions from 22 countries divulges that the rapid growth of digital technology is contributing to greater systemic financial risks globally, largely because nations differ in their levels of digital technology development and in the structure of their financial systems [34]. Liang et al. [24], whose baseline regression findings show that digital financial development (internet usage) contributes to the stability of commercial banks.

We set out to test how the maturity of digital finance technology in a country, proxied by internet penetration, shapes the association of digital financial inclusion with the stability of the banking system, especially in the setting of developing countries.

H3: Internet penetration level in a country contributes to a positive association of digital finance and bank stability.

3. Data description and methodology

3.1 Data description

This study utilizes a panel dataset covering 35 developing economies¹ over the period 2010 to 2021. The selection of countries and time frame is driven primarily by

⁵¹ This study covers sample from 35 countries including: Albania, Bangladesh, Botswana, Cambodia, Cameroon, Chad, Egypt, Eswatini, Fiji, Ghana, Guinea, Honduras, Hungary, India, Jordan, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Nigeria, Pakistan, Paraguay, Philippines, Qatar, Rwanda, Samoa, Senegal, Seychelles, Tonga, Turkey, Uganda, Zambia.

data availability on key indicators of digital finance. All selected countries are classified as developing economies, which provides a relatively homogeneous context compared to advanced economies. These economies tend to share structural characteristics such as limited financial infrastructure, lower levels of digital financial penetration, and greater banking sector vulnerabilities [19, 35]. Therefore, in this study, we examine whether digital finance improves bank stability for the aforementioned countries.

3.2 Model specification

Based on previous studies [6, 24], we specify the following linear model to be estimated as follows:

$$\ln Zscore_{it} = \beta_{0i} + \beta_{1i} \ln DF_{(VMMT)_{it}} + \gamma Controls_{it} + Year_t + \varepsilon_{it} \quad (1)$$

where $i = 1...N$ and $t = 2010...2021$; β_{0i} is a constant term; $\ln Zscore$ is the dependent variable which is a proxy for banking system stability and calculated as the natural logarithms of a country's Bank Z-Score; β_{1i} is the coefficient to be estimated for main variable of interests, digital finance, as recent studies, such as Al-Qudah et al. and Anagreh et al., highlight how mobile payments have become a central part of digital finance – especially in promoting financial inclusion [36, 37]. As smartphone use becomes more widespread, people are increasingly turning to mobile transactions instead of traditional banking services, with mobile payments standing out as the most accessible and convenient option. Therefore, in this study, digital finance is measured using two indices for mobile payment: the value of mobile money transactions in domestic currency ($\ln DF_{(VMMT)}$) and the number of mobile money transactions per 1,000 adults ($\ln DF_{(NMMT)}$); control variables include Bank assets to GDP (*Bank Assets*), Bank return on assets (ROA), Bank concentration (*Bank Compt*), Bank nonperforming loans to gross loans (BNPL), Bank capital adequacy requirement (CAR), Real gross domestic product per capita ($\ln RGDP$), World Governance Indicators (WGI), Financial Institutions Index ($\ln FII$), and Internet Penetration (*InterUsage*), respectively; $Year_t$ is the time effect; ε_{it} is an error term. The variables discussed above, and their respective sources, are described in detail in **Table 1**.

While Eq. (1) includes the standard variables commonly used in literature, it does not account for potential nonlinear effects in the relationship between digital finance and bank stability. To explore this, Eq. (2) adds a squared term for digital finance ($\ln DF_{(VMMT)_{it}}^2$) to test whether the relationship might follow a U-shape or an inverted U-shape – meaning the impact could either increase or decrease at different levels of digital finance.

$$\ln Zscore_{it} = \beta_{0i} + \beta_{1i} \ln DF_{(VMMT)_{it}} + \beta_{2i} \ln DF_{(VMMT)_{it}}^2 + \gamma Controls_{it} + Year_t + \varepsilon_{it} \quad (2)$$

Under this model, the impact of digital finance on bank stability ($\ln Zscore$) resembles an inverted U-shaped curve if $\beta_1 > 0$ and $\beta_2 < 0$, implying that initially digital finance may tend to increase bank stability before it would start to decrease it after digital finance reaches a certain threshold level. On the contrary, when $\beta_1 < 0$ and $\beta_2 > 0$, it is said that the relationship between digital finance and bank stability is U-shaped, indicating that digital finance may initially decrease bank stability, but this negative effect may be reversed after a certain threshold is reached.

Variable	Symbol	Definition	Data source
Bank Z-score	<i>LnZscore</i>	The Z-score measures the probability of default in a country's commercial banking system by assessing its overall financial stability. It reflects how well the system's capital buffer (i.e., capitalization and returns) can withstand shocks relative to the volatility of those returns. The Z-score is computed as: $Z = \frac{(ROA + (Equity/Assets))}{\sigma(ROA)}$ where: • ROA is the return on assets, • Equity/Assets represents the capitalization ratio, • $\sigma(ROA)$ is the standard deviation of the ROA. The standard deviation is calculated only for country-year pairs with at least five bank-level observations. Bank-level unconsolidated data from Bankscope and Orbis are aggregated at the country level to compute ROA, equity, and assets'. Z-scores are excluded for country-years with fewer than three observations.	World Bank
Digital finance	<i>LnDF_(VMMT)</i>	Value of mobile money transactions in domestic currency (during the reference year).	IMF
Digital finance	<i>LnDF_(NMMT)</i>	Number of mobile money transactions per 1,000 adults (during the reference year).	IMF
Bank assets to GDP (%)	<i>Bank Assets</i>	Deposit money banks' assets to GDP (%)	World Bank
Bank return on assets (% after tax)	<i>ROA</i>	Measure of banks' profitability, which is calculated as after-tax net income to annual averaged total assets of commercial banks.	World Bank
Bank concentration (%)	<i>BankConc</i>	The combined assets of the three largest commercial banks, expressed as a percentage of the total assets held by all commercial banks.	World Bank
Bank nonperforming loans to gross loans (%)	<i>BNPL</i>	The ratio of nonperforming loans – defined as loans with 90 days or more overdue principal or interest payments – to total bank's gross loans represents the full value of a bank's loan portfolio.	World Bank
Bank regulatory capital to risk-weighted assets (%)	<i>CAR</i>	The capital adequacy requirement of deposit takers: a measure of the capital strength of deposit-taking institutions, expressed as the ratio of total regulatory capital to risk-weighted assets. This ratio reflects the institution's ability to absorb losses based on the risk profile of its asset holdings.	World Bank
Real gross domestic product per capita	<i>lnRGDPPC</i>	GDP per capita (constant 2015 US\$).	World Bank

Variable	Symbol	Definition	Data source
World Governance Indicators	<i>WGI</i>	An average score that includes control of corruption, government effectiveness, political stability and absence of violence/terrorism, regulatory quality, rule of law, and voice and accountability.	World Bank
Financial Institutions Index	<i>lnFII</i>	The Financial Institutions Index evaluates the structure and performance of financial entities such as banks, credit unions, and other deposit-taking institutions. It measures their effectiveness in mobilizing savings, allocating credit, managing financial risks, and providing broad access to financial services. The index evaluates three dimensions: “Depth,” the size and scope of financial institutions; “Access,” the availability and reach of financial services; and “Efficiency,” how effectively these institutions operate.	IMF
Internet penetration	<i>InterUsage</i>	Individuals using the internet as a percentage of the total population.	World Bank

**Source: World Bank, Bank Z-score (GFDD.SI.01). <https://databank.worldbank.org/metadataglossary/global-financial-development/series/GFDD.SI.01>*

Table 1.
Description of variables.

Additionally, in this study we are interested in investigating the moderating role of internet penetration on the effect of digital finance on bank stability. This is done by including the interaction terms of digital finance and internet penetration ($LnDF_{(NMMT)it} \times InterUsage$), and also between the square of digital finance and internet penetration ($LnDF_{(NMMT)it}^2 \times InterUsage$), This is shown in Eq. (3) as:

$$lnZscore_{it} = \beta_{0i} + \beta_{1i}LnDF_{(VMMT)it} + \beta_{2i}LnDF_{(VMMT)it}^2 + \beta_{3i}LnDF_{(VMMT)it} \times InterUsage + \beta_{4i}LnDF_{(VMMT)it}^2 \times InterUsage + \gamma Controls_{it} + Year_t + \varepsilon_{it} \quad (3)$$

As noted by Anton and Nucu [17], one of the key challenges in estimating the relationship between digital finance and bank stability is the issue of endogeneity. When digital finance and bank stability potentially influence each other, traditional estimation methods can produce biased and unreliable results. In addition, unobserved factors that affect bank stability – if not accounted for – can lead to omitted variable bias and distorted conclusions.

To address these concerns, we utilize the instrumental variable GMM (IV-GMM) approach. IV-GMM not only helps correct for endogeneity and possible reverse causality but is also known to be robust in the presence of issues like autocorrelation and heteroscedasticity [38]. Given the difficulty of identifying strong external instruments, this study uses lagged values of digital finance as instruments² [39]. The validity of instruments is verified by using the Cragg–Donald/Kleibergen–Paap F-statistics test and the Hansen J test.

⁵⁴ Lags 1 and 2 of digital finance measures are used as instrument.

To check for robustness, we analyze the impact of variable measurement on the regression results. Accordingly, we re-estimate all models where the Value of mobile money transactions in domestic currency ($LnDF_{(VMMT)}$) is replaced by the number of mobile money transactions per 1,000 adults ($LnDF_{(NMMT)}$) as an alternative proxy for the digital finance variable.

3.3 Descriptive statistics

Table 2 reports the descriptive statistics of the variables employed in this study. Based on results from **Table 2**, the dependent variable, bank stability ($LnZscore$), has a mean value of 2.81 and a standard deviation of nearly 0.47, indicating a small variation among the 35 countries in our sample. However, the standard deviation for independent variables such as digital finance, Bank assets, Bank concentration, and internet penetration indicate significant heterogeneity among sample countries.

Table 3 shows the correlation matrix for all the variables considered in this study. As none of the independent variables exhibit correlations greater than 0.80, multicollinearity does not appear to be a concern.

4. Result discussions

Table 4 shows the results of the modelling. Model 1 results show no evidence of a linear association of digital finance ($LnDF_{(VMMT)}$) with bank stability ($LnZscore$). These results differ from some studies showing a positive relationship [24, 26, 27, 28, 24] and others showing a negative relationship [13, 12, 29, 14]. However, it is consistent with Kasri's study of Islamic banking which showed no significant

Variable	Observation	Mean	Standard deviation	Min	Max
$LnZscore$	374	2.8085	0.4656	1.4512	4.1342
$LnDF_{(VMMT)}$	317	23.590	5.8326	0.7765	32.910
$LnDF_{(NMMT)}$	311	7.7828	2.7256	-2.6799	12.179
Bank Assets	410	49.880	33.370	5.7140	235.36
ROA	370	1.8771	1.0547	-1.4466	6.7783
BankConc	375	62.600	20.961	25.313	100
BNPL	346	7.2038	5.1325	0.9347	28.626
CAR	345	17.958	4.8985	1.7547	39.451
$lnRGDPPC$	396	7.7300	1.0534	6.0472	11.310
WGI	384	-0.3294	0.5622	-1.3943	0.8702
$lnFII$	420	-1.3509	0.4612	-2.9005	-0.3242
InterUsage	410	32.100	24.396	1	99.7

Table 2.
Summary statistics.

<i>LnZscore</i>	<i>LnDF_(NMMT)</i>	<i>LnDF_(VMMT)</i>	<i>Bank Assets</i>	<i>ROA</i>	<i>BankConc</i>	<i>BNPL</i>	<i>CAR</i>	<i>lnRGDPPC</i>	<i>WGI</i>	<i>lnFII</i>	<i>InterUsage</i>
<i>LnZscore</i>	1										
<i>LnDF_(NMMT)</i>	-0.104	1									
<i>LnDF_(VMMT)</i>	-0.106	0.607	1								
<i>Bank Assets</i>	0.416	-0.216	-0.259	1							
<i>ROA</i>	0.202	0.182	-0.003	-0.343	1						
<i>BankConc</i>	0.159	-0.273	-0.490	-0.107	0.197	1					
<i>BNPL</i>	-0.404	0.097	0.115	-0.379	-0.097	-0.205	1				
<i>CAR</i>	0.148	0.196	-0.076	-0.078	0.334	0.101	-0.226	1			
<i>lnRGDPPC</i>	0.195	-0.283	-0.551	0.586	-0.071	0.233	-0.350	0.091	1		
<i>WGI</i>	0.139	-0.082	-0.596	0.460	0.092	0.279	-0.362	0.268	0.681	1	
<i>lnFII</i>	0.287	-0.278	-0.475	0.577	-0.086	0.254	-0.484	-0.028	0.659	0.642	1
<i>InterUsage</i>	0.279	-0.015	-0.385	0.636	-0.161	0.249	-0.279	0.061	0.818	0.626	0.517
											1

Table 3.
Correlation matrix of independent variables.

contribution of digital payments to bank stability [15]. The nonexistence of any linear relationship evident from our study may suggest a nonlinear relationship [17] or the effect of contextual variables affecting the direction of the relationship differently [12, 30–32, 40].

In the absence of any linear relationship, we first examine whether there exists any nonlinear association of digital finance with bank stability using Model 2. The results show strong evidence of a U-shaped relationship between the two variables. As digital finance transactions increase, bank stability initially declines; however, after reaching a certain threshold, bank stability rises.

	Model 1	Model 2	Model 3
$LnDF_{(VMMT)}$	-0.0058 (0.0098)	-0.1458** (0.0703)	-1.2452** (0.5062)
$LnDF_{(VMMT)}^2$		0.0028** (0.0014)	0.0247** (0.0102)
<i>Bank Assests</i>	0.0091*** (0.0017)	0.0079*** (0.0018)	0.0107*** (0.0025)
<i>ROA</i>	0.1615*** (0.0263)	0.1542*** (0.0260)	0.1407*** (0.0357)
<i>BankConc</i>	0.0031* (0.0017)	0.0021 (0.0016)	0.0023 (0.0026)
<i>BNPL</i>	-0.0175*** (0.0066)	-0.0146** (0.0067)	-0.0081 (0.0083)
<i>CAR</i>	0.0107* (0.0057)	0.0100* (0.0058)	0.0105 (0.0083)
<i>lnRGDPPC</i>	-0.2634*** (0.0553)	-0.3008*** (0.0530)	-0.3719*** (0.0830)
<i>WGI</i>	-0.2817*** (0.0769)	-0.2633*** (0.0758)	-0.3408*** (0.0977)
<i>lnFII</i>	0.16092 (0.1001)	0.2045** (0.0992)	0.0363 (0.1536)
<i>InterUsage</i>	0.0010*** (0.0025)	0.0117*** (0.0024)	0.2769*** (0.0535)
$LnDF_{(VMMT)} * InterUsage$			0.0246*** (0.00135)
$LnDF_{(VMMT)}^2 * InterUsage$			-0.0005* (0.0003)
<i>Constant</i>	3.8896*** (0.6673)	5.9936*** (0.1808)	9.5174*** (0.9168)

	Model 1	Model 2	Model 3
Obs.	160	160	157
R ²	0.5493	0.5552	0.3540
Year effect	Yes	Yes	Yes
LM statistics	40.591	16.466	10.928
LM JP	0.0000	0.0009	0.0274
Hansen J	0.8990	1.291	2.699
Hansen JP	0.3431	0.5245	0.4404
F-Statistics	602.88	101.30	21.023

Notes: LM statistics refer to the Kleibergen–Paap LM statistic, which tests the null hypothesis that the model is under-identified. LM JP represents the p-value associated with the Kleibergen–Paap LM statistic. Hansen J refers to the Hansen J-statistic, which tests over-identifying restrictions with the null hypothesis that the instruments used are valid, while Hansen JP reports the corresponding p-value. F-statistics represent the Cragg–Donald Wald F-statistics test for weak instrument identification, with critical values varying between 9.04 and 19.93, corresponding to maximal relative bias thresholds of 20% and 10%, respectively. The Hansen J p-value confirms no over-identification of instruments, while the F-statistic indicates that the instruments are not weak. Heteroscedasticity-robust standard errors are shown in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

Table 4.

Digital finance (value of mobile money transactions in domestic currency) and bank stability.

Figure 1 shows how bank stability is affected by the increase in digital finance transactions. The graph illustrates the predicted relationship between digital finance, measured by the natural logarithm of VMMT ($LnDF_{(VMMT)}$) and bank stability, captured by the natural logarithm of the Z-Score ($LnZscore$). It reveals a distinct U-shaped pattern: at lower levels of digital finance (approximately $LnDF_{(VMMT)}$ below 20), increases in digital financial development are associated with declining bank stability, possibly reflecting the initial disruptions, higher credit risks, or

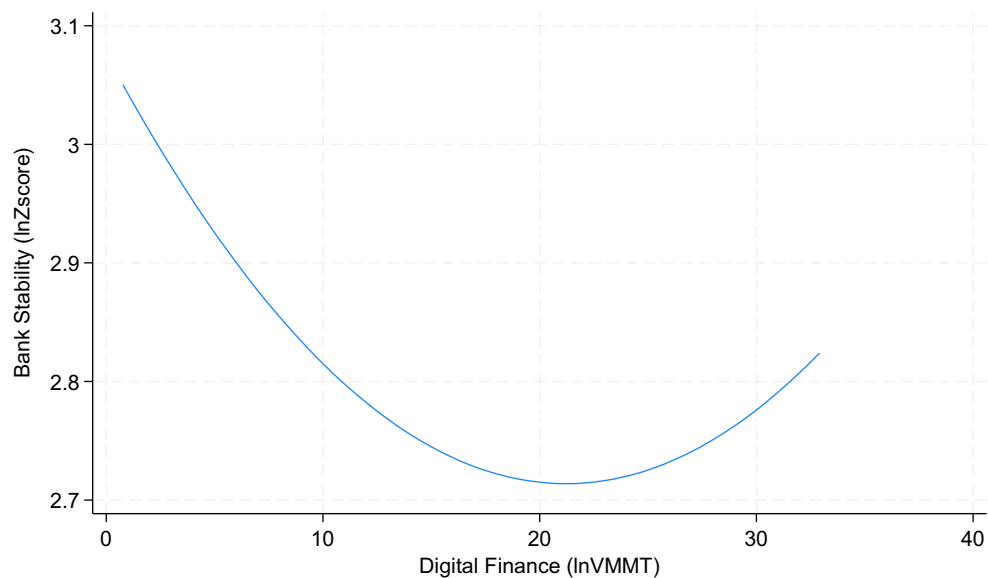


Figure 1.

Predicted bank stability versus digital finance.

regulatory gaps that often accompany early stages of digital transformation. However, beyond a critical threshold around $LnDF_{(VMMT)}$ of 20, further expansion of digital finance correlates with improvements in bank stability. This upward trend may indicate that, once a certain level of digital finance maturity is achieved, banks benefit from enhanced efficiency, broader financial inclusion, better credit risk management and more resilient financial infrastructures, which collectively strengthen their stability. The curve highlights an important nonlinear dynamic: the effect of digital finance on bank stability is not uniform but depends crucially on the level of digital financial development. Anton and Nucu [17] used a different methodology, namely quantile regression approach, and data from a combination of developed and developing economies and found evidence of such a nonlinear relationship. Yen and Dao's research [16] using bank-level data of 157 banks in eight ASEAN shows that financial inclusion should be above a specific level for it to contribute positively to stability of banks. Our results showing the U-shaped nexus between digital finance and bank stability are consistent with the above studies, albeit in different country contexts, and underscore the need for supportive policies that help the banking system move safely past the initial destabilizing phase toward long-term stability gain.

We now examine how the linkage between digital finance and bank stability is shaped by the contextual variable of internet penetration in developing countries. Model 3 results in **Table 4** reveal that both the interaction terms, $(LnDF_{(VMMT)}) * InterUsage$ and $(LnDF_{(VMMT)})^2 * InterUsage$ have a significant effect on how digital finance influences bank stability. The interaction effects are graphed in **Figure 2**. It shows how predicted bank stability ($LnZscore$) changes with digital finance ($LnVMMT$) in three scenarios of internet penetration level in the countries – low penetration (blue dashed line), average penetration (green solid line), and high penetration (red dash-dot line). When countries have low internet penetration, denoted by the blue curve, increases in digital finance transactions lead to a sharp

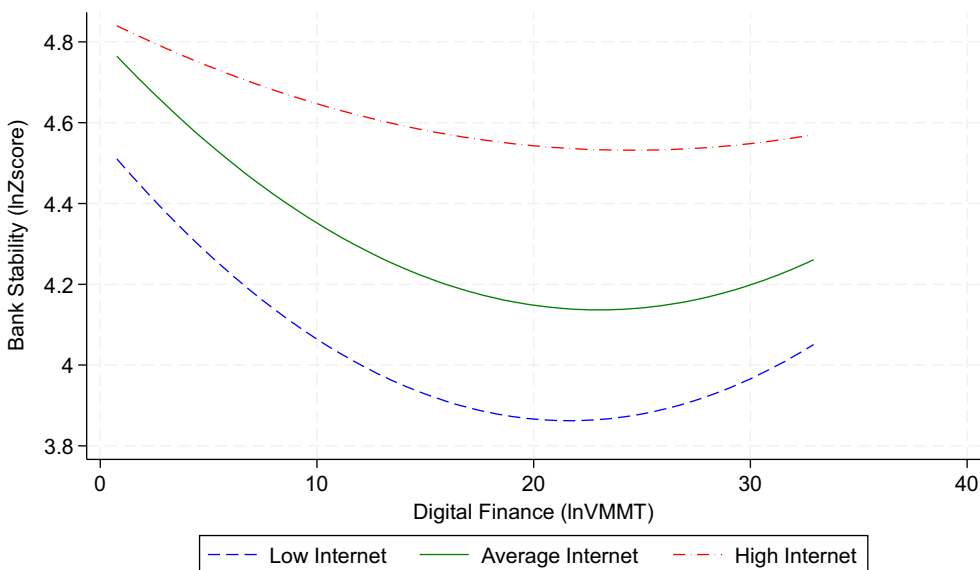


Figure 2.
Interaction effects of internet usage on the relationship between bank stability and digital finance.

decline in banks' financial stability until the trend is reversed after a threshold level (approximately 20) of digital financial transactions are reached. The red curve, representing high internet penetration scenario, is visually flattened and shifted upward to make it somewhat flat and stay well above the average internet usage line, highlighting that banks in countries with high internet use tend to experience a stronger but more stable impact of digital finance on their financial soundness. The shape of all curves reflects a nonlinear relationship, with stability first decreasing and then increasing as digital finance grows, but the impact varies depending on internet penetration levels. Ketterer [32] emphasizes the importance of robust digital infrastructure to support financial inclusion and bring about transformative progress in banking. Our finding provides empirical evidence to support the critical need for developing countries to invest in digital technology to advance sustainable financial inclusion. Finally, the p -values of the Hansen test in **Table 4** reveal that none of the three models over-identify the instruments used in them while results from the Cragg–Donald/Kleibergen–Paap F-statistics indicate that these instruments are not weak.

5. Robustness test

To test robustness of the results, we re-define the specification of digital finance variable as number of mobile money transactions per 1,000 adults ($LnDF_{(NMMT)}$) in Models 1, 2, and 3. These results, presented in **Table 5**, are consistent with those given in **Table 4**, which are based on digital finance variable proxied by the number of mobile money transactions per 1,000 adults ($LnDF_{(NMMT)}$), thereby supporting the key findings of this research.

	Model 1	Model 2	Model 3
$LnDF_{(NMMT)}$	-0.0244 (0.0169)	-0.1189** (0.0551)	-0.2022*** (0.0612)
$LnDF_{(NMMT)}^2$		0.0069* (0.0036)	0.0063* (0.0034)
<i>Bank Assests</i>	0.0088*** (0.0017)	0.0092*** (0.0017)	0.0089*** (0.0019)
<i>ROA</i>	0.1743*** (0.0292)	0.1582*** (0.0291)	0.1811*** (0.0278)
<i>BankConc</i>	0.0028* (0.0015)	0.0037** (0.0015)	0.0038** (0.0016)
<i>BNPL</i>	-0.0183*** (0.0066)	-0.0182*** (0.0063)	-0.0132** (0.0062)
<i>CAR</i>	0.0121** (0.0059)	0.0124** (0.0057)	0.0155*** (0.0053)
<i>lnRGDPPC</i>	-0.2732*** (0.0555)	-0.258*** (0.0544)	-0.4337*** (0.0587)

	Model 1	Model 2	Model 3
WGI	-0.2592*** (0.0708)	-0.2860*** (0.0691)	-0.2207*** (0.0701)
lnFII	0.1722* (0.1005)	0.1724* (0.0988)	0.1638* (0.0974)
InterUsage	0.0099*** (0.0027)	0.0091*** (0.0027)	0.0178*** (0.0055)
$LnDF_{(NMMT)} * InterUsage$			0.0595*** (0.0099)
$LnDF_{(NMMT)}^2 * InterUsage$			-0.0003*** (0.0001)
Constant	3.9843*** (0.5763)	4.1354*** (0.5829)	5.0904*** (0.5458)
Obs.	157	157	155
R ²	0.5693	0.5623	0.6400
Year effect	Yes	Yes	Yes
LM statistics	30.207	48.582	17.912
LM JP	0.0000	0.0000	0.0005
Hansen J	1.2280	3.5480	3.8730
Hansen JP	0.2678	0.1696	0.1442
F-Statistics	216.44	108.55	51.849

Notes: LM statistics refer to the Kleibergen–Paap LM statistic, which tests the null hypothesis that the model is under-identified. LM JP represents the p-value associated with the Kleibergen–Paap LM statistic. Hansen J refers to the Hansen J-statistic, which tests over-identifying restrictions with the null hypothesis that the instruments used are valid, while Hansen JP reports the corresponding p-value. F-statistics represent the Cragg-Donald Wald F-statistics test for weak instrument identification, with critical values varying between 9.04 and 19.93, corresponding to maximal relative bias thresholds of 20% and 10%, respectively. The Hansen J p-value confirms no over-identification of instruments, while the F-statistic indicates that the instruments are not weak. Heteroscedasticity-robust standard errors are shown in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

Table 5.
Robustness check – digital finance (number of mobile money transactions per 1,000 adults) and bank stability (LnZscore).

6. Conclusion

This study examines how digital finance impacts bank stability within the broader process of digitization across 35 developing countries between 2010 and 2021. It also examines how this relationship is shaped by the level of internet penetration in these countries. We find that the stability of banks does not have a linear relationship with the value of digital finance transactions, but rather a U-shaped relationship. The study also reveals that the financial stability of banks declines until it reaches a certain threshold. As digital finance transactions expand within the economy, financial stability begins to improve as digital transactions become more prevalent. The empirical results also show that the extent of internet usage is a key modifier of the nonlinear relationship described above. In an environment where only a low proportion of a country's population uses the internet, the financial stability of banks

declines at a fast rate until a certain threshold is reached and then increases as the volume of digital finance transactions increases. However, when a high proportion of a country's population uses the internet, the curvature of the U-shaped digital finance-financial stability curve is almost flat and shifts upward, signifying better and sustained stability of banks irrespective of the value of digital financial transactions. Therefore, this study provides strong evidence that the internet penetration level is a key differentiator in how the financial stability of the banking system is affected by the growth in digital finance transactions in developing economies.

The findings of this research have key implications for policy makers and managers involved in financial services in developing countries. In developing countries, the digitization of financial transactions provides an affordable pathway to deliver efficient banking services to millions of citizens, especially in rural areas, and to advance economic growth. However, developing countries are characterized by unique economic, political, technological, social, and governance challenges. These impediments raise the systemic risk of banking systems in such markets. Low capitalization of banks and weak banking regulatory and supervisory regimes compound their vulnerabilities. The findings of this research indicate that bank stability declines sharply before leveling off as the digitization of financial transactions increases in countries with low internet penetration. This highlights the need for robust preparation before banks embark on rapidly raising the volume of digital finance transactions to achieve social and economic benefits. Such preparations can include actions relating to better credit risk management policies for online transactions. Proactive management of credit concentrations, enhancing corporate governance, staff training at banks, strengthening regulatory capital requirements, and boosting prudential supervision are other areas that require improvement. Essentially, our finding that the U-shaped association between digital finance transactions and bank stability becomes flatter and shifts upward when the national internet penetration level is high suggests that the country should focus on building internet usage in the overall economy as a priority, rather than boosting the digitization of financial transactions in isolation. Presently, AI, generative AI in particular, is rapidly revolutionizing banking operations. Blockchain, cryptocurrency, and other fintech applications are becoming increasingly integrated into the delivery of mainstream financial services. This environment of transformative change in banking calls for fast-tracking the implementation of national strategies to increase internet usage in the economy. These strategies may include investments in technologies such as satellite communication to augment internet coverage and speed, making internet and mobile technologies more affordable, promoting digital awareness and literacy, and building public trust in data security on the internet by employing AI tools.

This study included data from only 35 developing countries and has used mobile financial transactions as the sole proxy for digital finance due to limitations in data availability. For the same reason, the bank Z-Score, which measures the credit risk vulnerability of banks, is used to measure bank stability, whereas the financial health of the banking system can also be affected by other risks, such as operational risks. Future research may focus on country-specific factors other than national internet penetration in shaping the relationship between digital finance and bank stability. For example, it would be helpful to explicitly examine the influence, if any, of the recent and evolving use of AI and data-centric approaches on this relationship.

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Chapter 4

Optimizing Tourism Web Usage Continuance Through Digital Marketing Analytics for Sustainable Competitive Performance

Ahmad Azmi Mohd Ariffin, Nik Mohd Hazrul Nik Hashim, Kifayat Nahiyen Rafi, Mohammad Imtiaz Hossain and Mohammad Osman Gani

Abstract

As the tourism industry increasingly transitions to digital platforms, the utilization of analytics to assess engagement metrics and optimize user experiences has become crucial for maintaining a competitive edge. This chapter explores the transformative role of digital marketing analytics in tourism web platforms, facilitating their evolution into agile, data-driven organizations. By providing valuable insights into user retention, click-through rates, conversion rates, bounce rates, session duration, and other key metrics, web and social media analytics are instrumental in real-time and evidence-based decision-making. Advanced web analytics capture the metrics needed to interpret user behavior and uncover customer sentiment, behavioral patterns, and shifting travel intentions across different stages of the online journey, enabling tourism marketers to identify friction points, respond to emerging preferences, and refine digital marketing strategies. Using these insights, intelligent tourism marketing initiatives deliver more sophisticated personalization and journey-level optimization, improving content relevance, interface flow, and targeting decisions in ways that deepen engagement, raise user satisfaction, and encourage repeat website visitation to sustain the competitive performance of online travel agencies. The chapter examines key components of an analytics-driven approach, including personalization strategies that enhance relevance, retargeting campaigns that reinforce brand recall, and real-time engagement techniques that support timely interaction and conversion. While the integration of these tools drives customer satisfaction, loyalty, and usage continuance, ethical concerns regarding privacy, data transparency, and potential misuse of consumer information are also addressed. These issues underscore the growing need for responsible data governance, consent-based tracking, and transparent analytics practices, which are essential for sustaining trust and long-term value creation in the digital tourism sector.

Keywords: digital marketing analytics, web analytics, eTourism, web usage continuance, predictive analytics, sustainable competitive performance

1. Introduction

In the IR4 era, tourism businesses are increasingly reliant on their digital web platforms to effectively engage with and retain customers [1]. Digital marketing analytics has become an indispensable instrument in this context, empowering tourism organizations to systematically harness customer data, evaluate multifaceted engagement metrics, and iteratively refine web-based user interactions [2]. Digital marketing analytics offers actionable insights [3] that enable tourism platforms to interpret and strategically enhance the key determinants influencing web usage continuance. This is achieved through the measurement of critical indicators such as bounce rates, session durations, return visit frequencies, click-through rates (CTR), and goal completions across both web and mobile user interfaces. The strategic alignment of analytics-driven digital marketing initiatives with overarching sustainability objectives reinforces competitive advantage by enabling tourism organizations to pursue continual innovation and respond proactively to evolving market dynamics [4].

The integration of marketing analytics has become pivotal for sustaining a competitive edge in today's digitalized and data-intensive business landscape [5, 6]. The targeted application of digital marketing analytics has the potential to transform conventional tourism platforms into agile, insight-driven enterprises. The incorporation of advanced analytical frameworks, including recommender systems and big data analytics, facilitates not only the personalization of user experiences but also the anticipation of shifting market demands and emergent operational challenges [7, 8]. This multifaceted analytical paradigm underscores the interconnection between technological innovation and sustained market competitiveness, as tourism organizations progressively depend on digital performance metrics to drive adaptive innovation, improve customer satisfaction, and reinforce competitive performance [9].

The systematic application of web analytics tools, such as Google Analytics, provides digital marketers with real-time, data-rich insights into key performance indicators, including website traffic, conversion efficiency, and levels of customer engagement, all of which are critical for the iterative refinement of digital marketing strategies [10–13]. Concurrently, social media analytics enable tourism marketers to systematically assess customer sentiment and engagement trends across diverse digital platforms, providing dynamic feedback on user interactions that can be utilized to fine-tune messaging strategies [14]. By synthesizing insights derived from both web analytics and social media analytics, which are two foundational components of digital marketing analytics, tourism marketers are equipped to construct adaptive, customer-oriented digital ecosystems that foster sustained user engagement. This integrated approach ultimately reinforces both operational effectiveness and long-term strategic competitiveness for tourism enterprises.

To further enhance web usage continuance, tourism marketers increasingly adopt advanced personalization mechanisms [15, 16] that curate digital content in alignment with users' individual preferences, behavior patterns, and contextual needs, thereby creating a more intuitive and engaging user experience [17]. Retargeting campaigns and real-time engagement, powered by sophisticated analytics tools, ensure that customers remain engaged by reminding them of

previously viewed services or destinations while offering immediate, contextually relevant recommendations [18]. Taken together, these analytics-driven strategies serve not only to elevate user satisfaction and engagement but also to bolster the sustainable competitive performance of destination marketing organizations within a highly dynamic and increasingly competitive digital marketplace.

2. Understanding web usage continuance in tourism

Understanding web usage continuance in tourism necessitates a comprehensive examination of the multifaceted determinants that drive tourists to consistently engage with digital platforms. In recent years, shifting digital consumption patterns have significantly reshaped the tourism landscape by seamlessly integrating mobile on-the-go accessibility with immersive virtual experiences. Tourism websites serve not only as gateways for the exchange of information but also as crucial platforms for fostering user satisfaction and encouraging continued engagement [19]. The enhancement of digital experiences within tourism websites further hinges on the strategic incorporation of immersive and interactive technological functionalities [1]. Interactive elements, such as virtual reality, have been demonstrated to create memorable experiences that fulfill users' immediate informational needs while simultaneously stimulating post-adoption continuance intentions [20].

The role of digital marketing analytics is central to elucidating the dynamics of web usage continuance. Advanced web analytics tools provide not only the critical metrics required to interpret and evaluate user behavior but also enable the formulation of nuanced personalization strategies that enhance engagement levels [10]. Intelligent tourism marketing initiatives, which utilize data-driven insights to tailor user experiences, have been found to elevate user satisfaction and encourage recurrent website visitation [21]. Furthermore, context-based digital marketing strategies allow tourism organizations to deliver individualized content that aligns precisely with the visitor's immediate needs, thereby increasing the likelihood of sustained web usage [22].

Through systematically analyzing web usage data, tourism organizations are equipped to refine overarching marketing strategies, optimize customer relationship management, and ultimately cultivate enduring loyalty among digital tourists [22, 23]. This cyclical process of persistent user engagement and rapid responsiveness not only maintains customer interest but also fortifies the operational resilience and long-term sustainability of tourism enterprises within a digitally driven economy [24]. Accordingly, a deep and data-informed understanding of web usage continuance, supported by sophisticated digital marketing analytics, emerges as a critical foundation for securing and sustaining competitive advantage in the tourism sector.

3. Methodology

This perspective chapter employs a narrative review of the literature on digital marketing strategies for e-tourism competitiveness. Most of the studies explored in this chapter were published in renowned peer-reviewed journals across tourism, information systems, marketing, analytics, and business, supplemented by selected book chapters and conference papers to broaden the evidence base. Following Rahman et al. [25] and using a thematic synthesis approach, the primary databases

consulted were Google Scholar and Scopus to locate pertinent literature. Key search terms included “eTourism Continuance,” “Digital Marketing Analytics,” “Sustainable Competitive Performance,” “Web Analytics,” “Social Media Analytics,” “Personalized eTourism,” and “Tourism Web Usage,” among others.

Screening proceeded in two stages. Titles and abstracts were reviewed for relevance to e-tourism competitiveness and analytics-driven marketing. Full texts were then assessed against inclusion criteria that prioritized conceptual clarity, methodological transparency, and practical implications for tourism marketers. We excluded items that were purely technical, outside the thematic scope, or unavailable in full text. The included studies were synthesized thematically to develop our perspective on how analytics-driven digital marketing, particularly personalization, retargeting, and real-time engagement, enables tourism marketers to refine strategies in response to customer sentiment and behavioral patterns, thereby supporting the continuance of tourism web usage and, in turn, sustainable competitive advantage.

4. Digital marketing analytics: Key tools and techniques

To optimize tourism web usage continuance, online tourism/travel agencies (OTAs) must strategically deploy a diverse range of digital marketing analytics tools and techniques. Given the escalating volume of data generated through digital consumer interactions, organizations can harness advanced analytics to facilitate data-driven strategic decisions that improve user experience, stimulate sustained engagement, and reinforce user retention. By tapping into comprehensive data from both web and social media channels, tourism marketers obtain critical, behavior-oriented insights that underpin evidence-based decision-making and support the continuous refinement of tactical marketing initiatives [10, 26]. This section delves into two fundamental dimensions of digital marketing analytics tools that are critical for tourism platforms.

4.1 Web analytics tools

Web analytics tools form the analytical foundation of digital marketing by measuring, collecting, analyzing, and reporting on website performance through detailed usage data. Google Analytics, the most prevalently adopted web analytics platform, utilizes embedded JavaScript tracking codes to monitor user navigation patterns across website interfaces, offering valuable insights into traffic patterns, engagement metrics, conversion rates, and campaign effectiveness [11–13]. These analytical capabilities are of paramount importance for tourism websites, where an in-depth understanding of visitor behavior is critical for mapping the digital traveler journey and assessing the strategic effectiveness of digital marketing initiatives [26].

4.2 Social media analytics tools

Complementing web analytics, social media analytics has emerged as an essential tool for tourism marketers [27], aiming to capture real-time consumer sentiment and interaction trends across a broad array of digital platforms. Social media platforms provide an abundant reservoir of user-generated content [28, 29], from which sentiment analysis algorithms can extract valuable insights regarding public opinions and emotions related to tourism products, destinations, and experiences [14]. By

examining the polarity, intensity, and thematic configurations within these sentiment patterns, tourism marketers are equipped to refine their communicative strategies in ways that enhance consumer trust, strengthen emotional engagement, and foster long-term brand loyalty [14].

5. Analytics-driven digital marketing strategies for tourism marketers' sustained competitiveness

A comprehensive, analytics-driven approach that seamlessly integrates personalization, retargeting, and real-time engagement is crucial for tourism marketers who aim to maintain and enhance their competitive performance. This section delves into the ways in which precisely targeted personalization, retargeting campaigns, and real-time engagement mechanisms contribute to tourism marketers' ability to sustain competitive advantages in dynamic market conditions.

5.1 Personalization strategies

5.1.1 Targeted content delivery

Tourism marketers increasingly utilize digital footprints, such as search histories, social media interactions, and online booking data, to craft highly personalized content that resonates with individual preferences [17]. Targeted content delivery on tourism websites not only elevates the user experience but also cultivates brand loyalty, which, in turn, helps OTAs sustain a competitive edge [30].

5.1.2 Dynamic content adjustment

Beyond static personalization, dynamic content adjustment is essential for maintaining relevance in an ever-evolving digital landscape. By continuously acquiring and analyzing real-time data, tourism marketers can consistently fine-tune the content presented across their digital platforms [17]. These dynamic adjustments ensure that communication remains highly relevant to the visitor's immediate context, thereby significantly increasing the probability of conversion and encouraging repeat visits. This iterative strategy aligns with the broader imperative of adapting to evolving consumer trends in real time, which is essential for maintaining a competitive advantage [31].

5.2 Retargeting campaigns

5.2.1 Remarketing and re-engagement

Remarketing ads represent a critical element of analytics-driven digital marketing by re-engaging travelers who have previously interacted with a brand's online presence. By utilizing detailed customer profiles derived from aggregated digital data, tourism marketers can deliver tailored advertisements that remind potential customers of destinations or services they previously explored.

5.2.2 Email retargeting

Complementing remarketing through display ads, email retargeting leverages data-driven segmentation and customized messaging to directly engage previous visitors. By incorporating insights derived from real-time data, email retargeting campaigns can quickly adapt to user behavior, ensuring that follow-up communications are both contextually pertinent and timely, thereby strengthening the likelihood of further engagement.

5.3 Real-time engagement

5.3.1 Chatbots and AI-driven support

The integration of AI-driven chatbots into digital marketing infrastructures is revolutionizing how tourism businesses engage with potential visitors [32]. By leveraging prior interactions and user-generated data in real time, chatbots can provide instant, relevant recommendations, thereby enhancing user engagement and fostering increased loyalty among visitors [18]. This innovative approach to customer interaction significantly boosts the potential for sustained relationships and higher conversion rates.

6. Challenges and ethical concerns

In the increasingly data-intensive landscape of tourism e-commerce, numerous challenges and ethical concerns have emerged as pivotal issues that require careful attention to ensure that the pursuit of innovation does not undermine essential ethical principles. The effective use of data through personalization, retargeting, and real-time engagement often comes into conflict with critical ethical imperatives such as privacy protection, transparency, and fairness. The extensive collection and analysis of user-generated content and web usage data bring forth significant ethical dilemmas related to data privacy, consent, and the potential misuse of personal information [33]. To address these challenges, tourism businesses must establish comprehensive data governance frameworks and strictly adhere to relevant data protection regulations in order to preserve consumer trust and minimize privacy risks [34].

Furthermore, the growing dependence on digital platforms and user-generated content for tourism marketing and decision-making brings forth concerns about the authenticity and reliability of the information presented [35]. Tourism marketers must remain vigilant to the risks of misinformation, manipulation, and the distortion of destination representations, taking proactive measures to maintain the integrity and transparency of their digital marketing efforts. Effectively addressing concerns surrounding data privacy, transparency, the ethical implementation of technology, and information integrity is essential to ensure the sustainable and responsible advancement of digital tourism. Ongoing collaboration among industry stakeholders, policymakers, and academic researchers is crucial in navigating the complex ethical and practical challenges that arise in this dynamic field.

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Perspective Chapter: From Training to Transformation – A Roadmap for Closing the Digital Skills Gap in South Africa’s Public Sector

Stella Bvuma

Abstract

The chapter explores the essential issue of the digital skills gap that exists in the South African government sector and suggests a strategic change in the approach from site-based training to comprehensive digital transformation. It outlines the major obstacles, such as the lack of infrastructure, policy fragmentation, and disproportionate access to training, that obstruct the creation of a digitally competent workforce. The discussion reveals the limitations of the existing up-skilling programs, which are usually not customized, do not consider practical relevance, and do not comply with the long-term objectives of the organization. In turn, the chapter suggests a systematic approach to change based on the commitment of leadership, continuous learning, adoption of innovation, and development of a digital mindset. It provides practical measures such as targeted training, corporate–government collaboration, and incorporating digital literacy into recruitment and career growth. Finally, the chapter recommends a more systemic and integrated understanding of skills development, in which enhancing service delivery, operational efficiency, and citizen satisfaction are interrelated, making digital capability one of the foundations of modernization in the South African public sector.

Keywords: digital skills gap, public sector transformation, e-governance, capacity building, organizational change, citizen engagement

1. Introduction

In the twenty-first century, digital transformation has become one of the key factors of economic growth, societal development, and institutional performance in the world [1]. Governments and organizations across the globe are using digital technologies to enhance the delivery of services, increase operational efficiency, and foster innovation. Digital transformation is the approach toward embracing digital technologies in every field of public administration and fundamentally altering the nature of service provision and communication between citizens and government bodies [2]. The extensive effect of digital adoption on the governance of the public

sector, where technology not only improves administrative processes but also promotes transparency, accountability, and the level of interaction among citizens, has been demonstrated by countries like Estonia, Singapore, and South Korea [3–30]. Such trends across the world highlight the need for a digitally proficient workforce that can implement, manage, and maintain technological projects for governments.

The pressure to modernize in the South African context is also growing to meet an increased demand among citizens, technology, and more effective provision of public services [31]. Digital skills are now needed to help employees of the public sector carry out their duties efficiently, administer informational systems, and adopt new technologies like cloud computing, artificial intelligence (AI), and data analytics [23]. The ability to leverage available digital tools has not only an effect on the efficiency of operations but also on the quality of governance and decision-making processes. In addition to this, a digitally skilled workforce is fundamental in promoting innovativeness and resiliency within state institutions, especially during periods of high rates of technological disruption and socio-economic predicaments [18]. In the absence of these capabilities, South Africa will be outmaneuvered by the world in terms of digital governance and fail to be in a position to address the service delivery needs of its people.

Although there have been attempts at digitizing government services, the South African government sector still faces a significant digital skills deficit. Various investigations show that a number of government institutions lack workers with the necessary technical expertise, digital literacy, and adaptive aptitudes to succeed in digital transformation [32]. This gap has been expressed in various aspects: a lack of knowledge about digital tools, underdeveloped training in new technologies, and a lack of leadership to drive the adoption of technology. The effects are far-reaching and include inefficiency in service delivery, increased operational costs, and diminished trust in government institutions among the population [16]. Moreover, the digital skills gap exacerbates inequalities in the workforce, as those with access to technology and training perform better than others who do not, creating systemic issues that make a comprehensive transformation impossible.

Digital skills gap, thus, is not only a training issue but a holistic process that is a combination of capacity building, organizational change, and strategic planning [33]. The chapter aims to identify what the digital skills gap is in the South African public sector, critically analyze current training programs, and suggest a roadmap leading to the shift from traditional training to the transformational approach to digital capabilities development. The purpose of this chapter is to add to the academic discussion of digital governance and also provide practical solutions to policymakers, public administrators, and educators on how to develop a digitally competent workforce. Having discussed the obstacles and opportunities linked to developing digital skills, the chapter sheds light on how the public institutions of South Africa can change their current practices of implementing incremental training programs into opportunities for complete transformation into digital programs.

This chapter includes a review of the modern situation regarding digital skills in South African public institutions, the definition of the main obstacles to the development of these skills, and a discussion of the strategic interventions that can help create sustainable change [34]. It highlights the relationship between skills development, organizational culture, policy systems, and the adoption of technology. Although the chapter focuses on South Africa, the author relies on global best practices and comparative studies to offer a broader understanding of the steps, tactics, and systems that have been effective in closing digital gaps in capacities

among the masses in government. Finally, this chapter aims to emphasize the essential nature of digital skills as the driver of change in the public sector and to provide a systematic way of bridging the gap between training and actual, organization-wide change.

2. Understanding the digital skills gap

2.1 Digital skills in the public sector context

Digital skills refer to a set of skills needed to successfully apply digital technologies, tools, and systems to perform tasks, solve problems, and innovate in an organizational context [4]. These skills in the field of the public sector are not limited to essential computer literacy but extend to data management, cyber security, cloud computing, digital communication, and the application of new technologies, such as AI and machine learning [35]. Moreover, digital skills also include the ability to adapt to new technology, analyze digital solutions, and incorporate them into the administrative workflow. In the case of public sector workers, these skills are not only required on a technical level but are also a strategic necessity to help them effectively provide services to people, make sound decisions, and respond to the changing demands of citizens in the digital age [8]. Essentially, in the public sector, digital skills are the pillars for delivering innovation, enhancing governance, and ensuring that government institutions do not become obsolete and irrelevant in a fast-evolving technological environment.

This framework (see **Figure 1**) describes the cyclical nature of the relationship between digital government maturity and workforce development. The three interrelated pillars are highlighted to mean that, to experience positive digital transformation, there is a need to invest in the organizational environment, technical

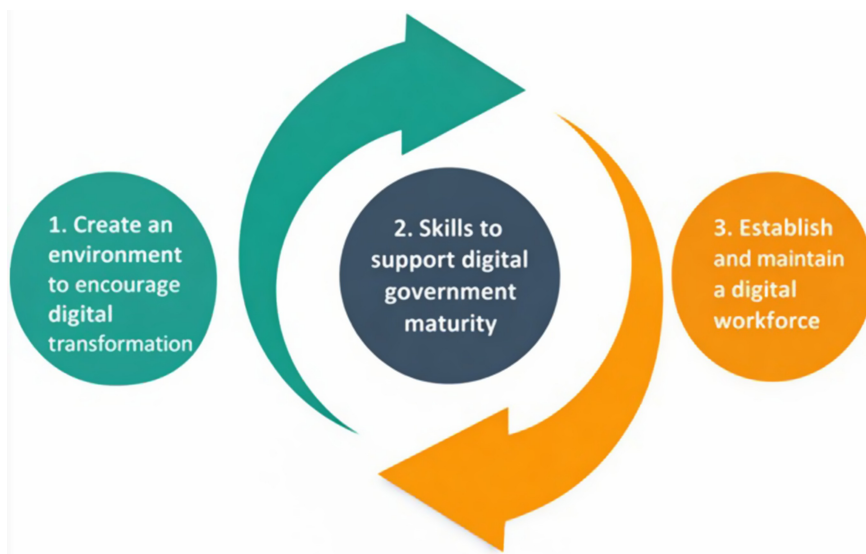


Figure 1.
The OECD framework for digital talent and skills in the public sector. Source: OECD [36].

capabilities, and human assets at the same time. These elements imply that they are reinforced by continuous iteration and vicious circles, as indicated by the circular arrows.

2.2 Key challenges causing the skills gap

There are various reasons that lead to the digital skills gap in the South African public sector, which include infrastructure, policy, socio-economic, and educational constraints. To begin with, the infrastructure issues, including poor internet coverage, obsolete hardware, and limited access to digital platforms, undermine employees' ability to formulate and implement digital competencies [25]. Many government structures, especially the rural ones, do not have the technology needed to facilitate digital programs. Secondly, there are policy gaps, such as the lack of a coherent national digital skills policy and departmental piecemeal policies, which curtail systematic workforce development [29]. Without these policies and standards, training activities will be inconsistent and not aligned with the overall digital transformation objectives. The socio-economic aspect is also a contributing factor, as unequal access to education and technology exposes the unequal potential of workers in the public sector to learn digital skills [28]. Lastly, educational disparities, such as poor digital literacy in secondary schools and institutions of higher learning, as well as the lack of professional development courses, worsen the situation. These are interconnected issues that create a systemic block to ensuring that the public sector is able to produce a labor force that is ready for digital transformation.

2.3 Implications of the digital skills gap on public service delivery, efficiency, and citizen engagement

The implications of the digital skills gap in the public sector of South Africa are extensive and touch on various aspects of governance and the provision of services [17]. The ineffective application of technology leads to slow administrative practices, repetition of duties, and higher operational costs. Staff who are not digitally competent cannot control information systems, effectively analyze data, or realize the use of e-governance initiatives, which may lower the quality of the provided services. Moreover, the digital skills gap has a direct impact on the level of citizen engagement, as government websites cannot provide citizens with a smooth online experience, enhance transparency, or address their inquiries in a prompt manner [37]. In a world where citizens are growing progressively demanding of digital access to government services, failure to comply with such demands may undermine the level of trust and confidence that people have in institutions. Additionally, the skills gap negatively affects innovation in the government sector, restricting the implementation of new technologies that can make processes more efficient, streamline operations, and improve policy outcomes. The digital skills gap is thus a key area of concern in helping provide institutions with the ability to offer high-quality, responsive, and citizen-centric services.

The allocation of digital competencies among the occupational groups of people in South Africa can be observed based on the national labor statistics, which show a large disparity in the intensity of digital skills among different occupations (see **Table 1**).

Digital level	Occupation	Digital score
High	Computer programmers	92.1
High	Electrical engineers	76.5
High	Geologists and geophysicists	69.0
Medium	Data entry operators	58.9
Medium	Dental assistants	50.6
Medium	Firefighters	46.1
Low	Plumbers and pipe fitters	30.2
Low	Building construction labourers	16.3
Low	Shoemakers and related workers	10.0

*Statistics South Africa (2010, 2020), authors' calculations; study by Borat et al. [38].
Source: Study by Borat et al. [38].*

Table 1.
Digital skill levels and digital scores across selected occupations.

Table 1 shows huge digital skills gaps in occupations, with the highest marks being computer programmers (92.1) and the lowest ones being shoemakers (10.0). The hierarchy shows that technical and engineering careers demand a lot of digital skills, whereas manual skills are still quite manual. Interestingly, data entry operators representing a medium-level job report medium scores, which implies that basic digital literacy is becoming a primary requirement in various industries, making it immediately necessary to upskill the low-scoring workforce.

2.4 Comparative insights from other emerging economies

Other developing economies have offered useful insights that South Africa can learn from on how to deal with the digital skills gap. Similar problems have been experienced in countries like India, Brazil, and Kenya during the transition of their public sectors, despite limitations in technology and socio-economic factors [39]. An example would be India, whereby, through e-governance initiatives, government employees are given specific digital literacy programs that have enhanced service delivery in urban and rural communities. Brazil has been investing in public–private relationships to improve digital training and infrastructure, ensuring that civil servants can use technology to implement their policies and deliver services to citizens [11]. Kenya’s strategy focuses on capacity building by organizing continuous professional development and certification of digital skills, which provide employees with the ability to meet changing technological requirements. These illustrations point to the fact that solving the digital skills gap involves a complex approach that includes training, policy alignment, infrastructure building, and cross-sector collaboration [40]. By observing the experiences and failures of other emerging economies, the South African government can employ specific interventions to respond to local requirements and develop a digitally skilled and transformative public sector workforce.

3. Current training initiatives and limitations

The South African government has identified the need to acquire digital skills in the public sector and has developed a number of training programs designed to enhance the up-skilling of government workers [41]. Programs such as the Government-Wide Digital Skills Training Program are provided by the Department of Public Service and Administration (DPSA) and aim to improve digital literacy, basic IT skills, and the ability to use popular programs [7]. Moreover, collaborations with local institutions of learning and training offer short courses and certification programs in fields like data management, cyber security, and e-governance. E-learning modules and online learning platforms have also been implemented to make accessibility for employees in different departments more seamless [26]. These programs are indicative of a strategic initiative by the government to close the digital skills gap and provide employees with the underlying knowledge base needed to launch digital transformation efforts.

3.1 Analysis of successes and failures

Although some successes have been made in these training programs, such as enlightenment about digital tools and offering basic skills, their overall effect has been minimal. The evidence of success is the growth of digital literacy among junior employees and the possibility for some branches to implement basic digital procedures. However, the lack of success is observed in certain areas, including the lack of depth in training, the low rate of completion, and the absence of the application of the learned skills to real-life operations [42]. Some of the programs have not been successful in meeting the diverse needs of the employees, thus leading to the development of skills in different departments, which has been unevenly distributed. Furthermore, skills acquisition has not been sustainable due to the lack of follow-up and mentoring during the training sessions, and thus, we have a situation where an employee might have the theoretical knowledge but is unable to apply the skills practically in a complex and real-world situation.

3.2 Gaps in training approaches

Recent training programs mostly revolve around a one-size-fits-all approach, which does not consider the different roles and duties of employees in the entire public sector or the competencies present in the employees [27]. This generic approach inhibits involvement and makes the training material less practical. Moreover, most of the programs are highly theoretical, not practical or experiential, and therefore many employees are not equipped to cope with real-life digital tasks at their workstations. Another important restriction is outdated material, where fast-changing technologies make some modules outdated or not comprehensive enough. Furthermore, training is not always associated with larger organizational strategies; that is, it can happen that even well-trained employees will not be able to fully use their digital capabilities, and these gaps will reduce the effectiveness of the initiatives in the long run [5].

3.3 Case studies of programs from different departments

There are different departments that have tried to introduce digital skills programs with either success or failure. For example, the South African Revenue

Service (SARS) has introduced e-learning initiatives on digital tax administration and data analytics, which have enhanced the efficiency of personnel working with electronic submissions and audits [2, 22–31, 33, 34, 36, 37, 40, 43–54]. On the contrary, the Department of Health has faced difficulties training employees to work with electronic health records due to uneven infrastructure and the absence of customized and practical training [55]. The Department of Home Affairs has tested digital service kiosks, which require staff to become accustomed to new technologies; however, without proper continuous learning and guidance, most employees have failed to perform at top levels. These instances demonstrate the opportunities and constraints of existing training programs and the necessity of organized, practical, and context-based training programs that correspond to the needs of departments and the overall purposes of change transformation in the public sector.

4. Methodology

The chapter uses a conceptual synthesis framework based on the available academic literature, policy reports, and international comparative case studies to explain the digital skills gap in the South African public sector. As opposed to the empirical experiment, the methodology is grounded in the integrative review and critical analysis, in which the knowledge provided by numerous sources is consolidated to construct a consistent framework on the topic of digital transformation.

The analysis incorporates three methodological strands:

- **Conceptual synthesis:** Current theories in digital transformation, capacity building, and innovation in the public sector are synthesized and built into a complete picture regarding the digital skills gap. This includes linking the loose pieces of knowledge in academic research and global and local government reports into a coherent system.
- **Policy analysis:** National and departmental policy with regard to digital skills and e-governance is critically analyzed to identify gaps, inconsistencies, and areas of systemic enhancement. This policy-oriented prism guarantees that the recommendations will have contextual entrenchment within the framework of South African institutional realities.
- **Comparative case-based review:** Lessons are based on the experiences of other emerging economies (e.g., India, Brazil, and Kenya), which have used digital skills programs. Such cases are not replicated but serve as illustrative comparisons to derive actionable insights applicable to the South African context.

Considering this conceptual orientation, there is no replicable scientific sense of experimental design that could be followed in the chapter. Nevertheless, rigor is achieved by providing a systematic selection of the literature, triangulating the sources, and critically interacting with global best practices as well as local contextual challenges. This strategy will increase the validity of the suggested framework and make it more practical in the eyes of policymakers, managers, and teachers.

5. Training to transformation a conceptual framework

Although conventional courses in digital skills provide employees with basic technical knowledge, it is not enough to enable sustainable change in the organization within the public sector. The change will entail a shift in organizational culture, processes, and output that goes beyond personal competency building. Digitally competent employees should work in an environment where technology, innovation, and constant improvement are integral to its culture. Such a cultural change means creating an environment in which experimentation, knowledge exchange, and new modes of working are promoted [56]. Process redesign also involves rethinking administrative processes to incorporate the use of digital tools and automate repetitive tasks to make operations smoother. Furthermore, transformation is not only quantified in terms of training accomplishments but rather by actual results, such as the delivery of better services, citizen satisfaction, and the effectiveness of policies [14]. Training is unlikely to achieve sustainable benefits or reduce the digital skills gap in the public sector without a holistic approach that addresses culture, processes, and outcomes together.

To go beyond the standalone training programs, there must be a comprehensive change strategy that involves the aspects of culture, process, and performance results, as shown in **Figure 2**.

This framework shows that digital transformation is not merely about the implementation of technology, but it relates to cultural, procedural, and performance aspects. The interlinked segments emphasize the need to develop an innovative culture, redesign workflows, and measure improved results as a whole approach. To be successful, it is necessary to strike a balance between these three factors instead of concentrating on technological adoption.

5.1 Components of transformation

The four components, which are interrelated and essential to successful digital transformation in the public sector, are as follows. To begin with, leadership commitment is essential; the leaders define the change direction, distribute funds, and promote digital initiatives [46]. In the absence of apparent encouragement at the top level, employees can become unmotivated or feel that the development of digital skills is an extraneous task. Second, it is important to engage in continuous learning in order to adjust to swiftly changing technologies. The training should be continuous, dynamic, and in line with new trends so that employees will be able to refresh their skills and adapt to the dynamic needs of the operation [57]. Third, innovation adoption refers to the readiness to test new technology, experiment with alternative digital solutions, and introduce new practices into delivering services to citizens [12]. The staff also has to be empowered to break the conventional ways of doing things and seek innovative ways of solving problems. Lastly, the development of a digital mindset that is flexible, receptive to change, and has the capacity to make data-driven decisions is what will ensure employees internalize the digital competencies and put them to use as a strategic approach [58]. All of these elements contribute to the creation of an environment in which training transforms into organizational change and incorporates digital skills into the system of organized bodies.

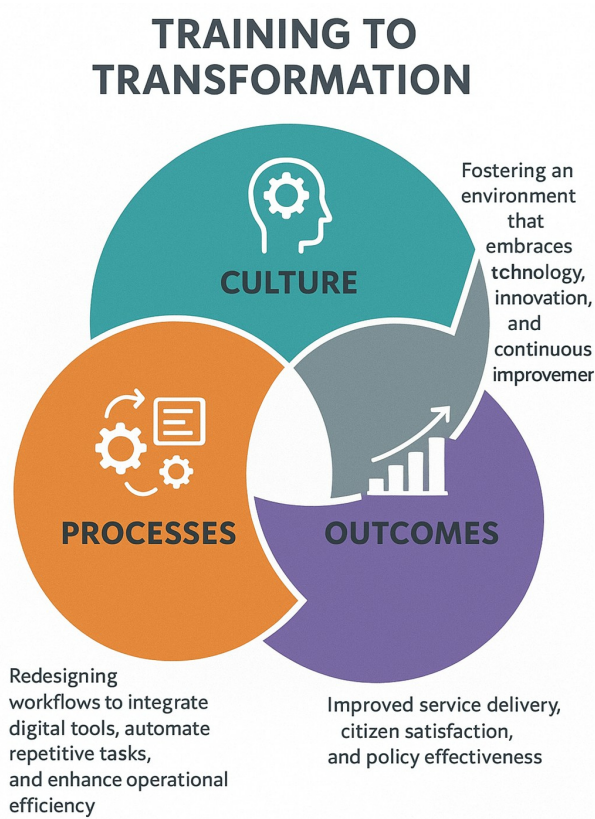


Figure 2.
 Source: Study by Maira Afzal [41].

5.2 Model for skills transformation in the public sector

A systematic design is needed to execute the transition between training and transformation. The Digital Skills Transformation Framework proposed includes four stages interrelated with each other; these are assessment, development, integration, and evaluation [59]. During the “assessment” stage, organizations conduct a careful analysis of current skills, define the gaps, and check the technological preparedness of departments. The “development” stage involves designing customized learning programs covering both technical skills and strategic competencies, with the inclusion of experiential learning, mentoring, and e-learning mediums [44]. “Integration” focuses on the incorporation of new skills into day-to-day operations, organizational processes, and service delivery mechanisms. This phase involves workflow redesign, technology adoption, and developing a collaborative culture that embraces digital innovation. The last phase, “evaluation,” involves quantifying the effects of skills improvement on the performance of the organization, tracking progress using key performance indicators (KPIs), and updating approaches to maintain change [60]. This cyclic model guarantees that the skills development process is ongoing, context-dependent, and connected with the overall organizational goals, hence transcending single training initiatives to systemic change.

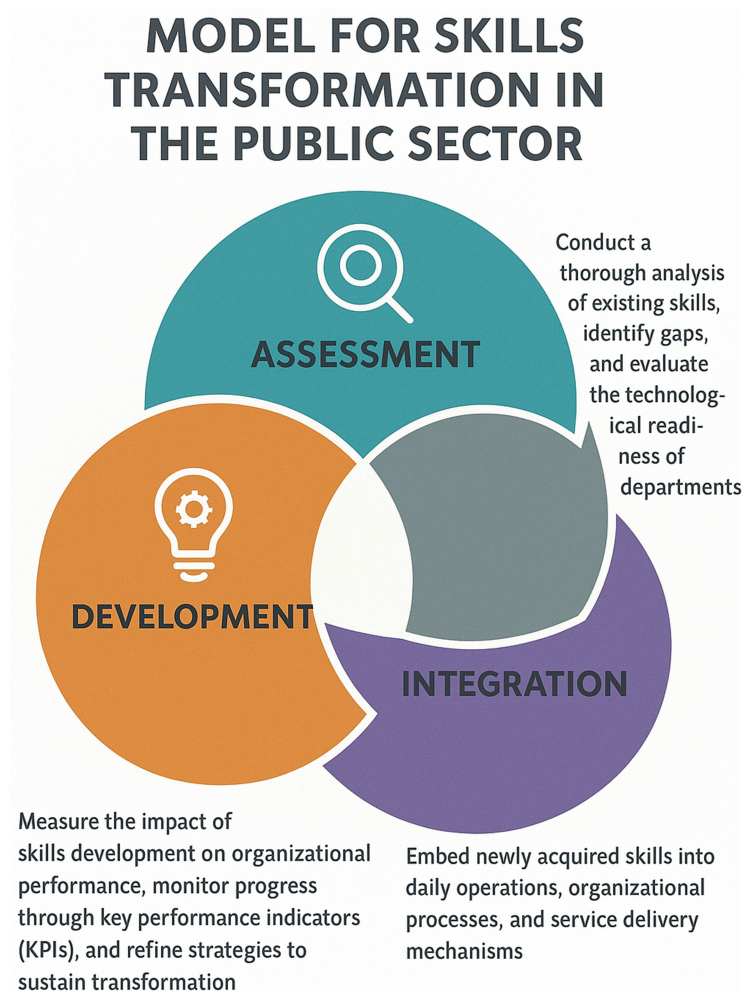


Figure 3.
Source: Team, D.A. [61].

In order to operationalize how skills development may be transformed into organizational change, a cyclical transformation model is suggested, which connects the assessment, development, integration, and evaluation (see **Figure 3**).

This is a cyclical model that offers skills transformation as a continuous process instead of a single intervention. Evaluation reveals the gaps, growth creates the capabilities, and assimilation incorporates the new capabilities into the business. The framework focuses on impact measurement using KPIs and constantly upgrading strategies, so that skills development is converted into the reality of organizational change and improvement of service delivery.

5.3 Linking skills development to organizational performance and citizen outcomes

The last part of the product of digital transformation in skills is to improve the performance of organizations and citizen outcomes. Proficient employees in the

digital instruments of the public sector will help deliver services more efficiently, make decisions more quickly, and become more accurate in administration [19]. Improved digital capabilities allow the application of data analytics in policy-making, resource distribution, and performance tracking, which results in evidence-based governance [15]. Therefore, people enjoy more convenient, available, and accountable public services, boosting confidence in governmental institutions. To connect skills training and development with performance, it is important to combine the training objectives with departmental goals, establish measurable outcomes, and monitor how the skills are applied in real-life tasks. Furthermore, digital competencies facilitate the ability of public institutions to make innovative service offerings, including providing online portals, automated services, and data-driven insights, which have a direct effect on citizen satisfaction and engagement [13]. Public sector institutions can achieve this by positioning employee competencies, organizational performance, and citizen-based outcomes in a clear relationship to establish that digital transformation will provide real value to employees and the communities they serve.

6. Strategies for closing the digital skills gap

6.1 Tailored training programs and up-skilling initiatives

The development of specific training programs and up-skilling initiatives is one of the best options to solve the digital skills gap in the South African public sector. Generic training modules are not usually able to address the needs of employees in different departments, roles, and skills, as well as the needs of employees at different levels. Tailored programs, on the other hand, take the competencies of each function into account, enabling learning and application to be more effective. For example, Department of Health data analysts might need training on complex data visualization and analytics, whereas frontline employees in services might need to learn digital customer service and basic IT proficiency [21]. Hands-on practice, project-based learning, and mentoring should also be part of up-skilling initiatives, as employees are allowed to apply their newly gained knowledge in practice. Additionally, such programs must be constantly updated in accordance with technological changes and the evolving demands of the population sector. With context-specific and competency-based training design, public institutions will be able to help employees acquire relevant skills that directly lead to increased efficiency in operations and service delivery.

6.2 Public-private partnerships and collaboration with tech companies and Universities

The other important strategy is to take advantage of public-private partnerships and collaboration with technology companies and academic institutions. Such collaborations open access to the latest knowledge, resources, and experience that are not present in the public sector [45]. Technology companies will be able to provide specialized training programs, certifications, and tools, whereas universities will provide insights from research, advanced coursework, and customized programs to government employees [48]. For example, collaboration with companies such as

Microsoft, IBM, or regional technology startups can be used to conduct workshops on new technologies such as AI, cyber security, and cloud computing [53]. Similarly, partnerships with universities can aid in the creation of modular courses that involve both theoretical materials and practical applications. Continuous learning and innovation are also fostered by such partnerships, allowing employees to keep up with trends in technology. With the involvement of external expertise and its connection to the needs of the population, South Africa can accelerate the development of digital skills and stimulate the exchange of innovations and knowledge.

6.3 Policy interventions and incentives

The policy interventions are essential to reduce the digital skills divide by establishing an enabling regulatory and organizational framework. The national and departmental policies must explicitly demonstrate the necessity of digital skills, develop competency standards, and ensure that public sector personnel continue to develop professionally [62]. Employees can be encouraged to actively engage in skill development through rewards such as recognition awards, opportunities for career progression, and financial assistance toward training [50]. Additionally, the policies must provide equal opportunities for training, especially for workers in under-resourced or rural regions, to avoid disparities in skills development. Policies that promote cross-departmental cooperation and knowledge exchange, fostering a culture of learning and innovation, can also be implemented by governments. Policy interventions can be leveraged to create systematic and sustained improvements in the development of a digitally skilled workforce, enabling greater transformation goals in the public sector through a combination of regulatory frameworks and tangible incentives.

6.4 Integrating digital literacy into recruitment and career development

Digital literacy should be incorporated into recruitment strategies and career development models to ensure a workforce that is not only ready to meet existing needs but also flexible to adapt to dynamic technological advancements. Job descriptions and selection criteria must specifically focus on digital competencies so that new employees are equipped with the basic skills necessary to perform efficiently in the context of providing services to people. Moreover, the incorporation of digital skills into continuing professional growth and performance reviews will promote the lifelong learning process and emphasize the significance of adopting technology. Employees must also receive organized development opportunities that involve certifications, skills tests, and development prospects with consideration of digital abilities [36]. Through digital literacy in hiring and professional growth, the public sector will be able to create a workforce that is not just technically effective but also committed to developing and continuously updating their skills, which will narrow the gap in skills over time and make institutions more resilient during technological disruption.

6.5 Leveraging e-learning, micro-credentials, and blended learning

Alteration in the fast-paced technological change will demand flexible and accessible educational solutions, and e-learning, micro-credentialing, and blended

learning will be key to reducing the digital skills gap. E-learning sites enable employees to train freely based on their schedules and geographical restrictions, and they also offer different timetables [10, 11]. With a narrow scope and competency-specific learning, micro-credentials allow employees to acquire skills progressively as they demonstrate the effects of learning. With blended learning, a combination of online modules and face-to-face workshop sessions, employees will be more engaged and practical, and it is necessary that they can apply theoretical knowledge to the field [50]. Moreover, using online learning resources would enable institutions to monitor and assess progress and make content adjustments in response to emerging demands and feedback. These strategies make education more democratic, encourage life-long learning, and enable employees to improve their digital skills to keep up, thus improving the general ability of the public sector workforce to promote digital change initiatives.

7. Implementation roadmap

7.1 Step-by-step guide to implementing digital skills transformation

The process of digital skills transformation in South Africa's state sector should be organized and implemented in a phased manner to align with its organizational aims and ensure sustainability over time [24]. The first step is to conduct an extensive skills audit to determine which competencies are already present, which gaps need to be filled, and which employees and departments should be prepared to undergo digital transformation. The second step involves the creation of a strategic digital skills plan that includes goals, schedules, and resources needed to implement them, including customized training programs and upgraded infrastructure. The third step focuses on planning and implementing specific training and up-skilling programs, combining practical exercises, mentoring, and ongoing learning. The fourth step involves incorporating digital skills within organizational processes so that employees can utilize the new skills gained in their day-to-day operations. Lastly, the fifth step emphasizes maintaining change by conducting frequent assessments, modifying training materials, and reinforcing the digital culture within the organization. The stepwise roadmap, based on this phased plan, will help embed digital skills development as an organization-wide change rather than an isolated training program.

7.2 Risk assessment and mitigation strategies

Digitizing the capabilities of the public sector is also associated with a number of threats that should be actively addressed. Among these threats is employee resistance, an important risk due to the fact that it may make employees feel rather uneasy about new technologies or afraid of losing their jobs [48]. Mitigation methods include effective communication, engagement of employees during decision-making, and the establishment of continuous support. Poor infrastructure is another risk that may create impediments to training access and restrict the use of digital tools [20]. The solution to this includes investing in hardware, software, and network connectivity, especially in under-resourced areas. There is also the issue of policy and regulatory restrictions, whereby implementation can be hindered by

inconsistent guidelines or the irrelevance of such guidelines. Some mitigation strategies include ensuring that initiatives are aligned with national digital policies and developing clear departmental protocols. Lastly, there is the perpetual threat of skills obsolescence due to fast-changing technologies. This can be addressed through regular updates to training materials, the provision of refresher courses, and fostering a culture of continuous learning. By raising the chances of successful digital skills transformation through constructive risk identification and mitigation strategies, the institutions within the state environment will ensure greater success in acquiring digital skills.

7.3 Monitoring and evaluation

Monitoring and evaluation (M&E) are crucial to guaranteeing that digital skills programs provide quantifiable outcomes and lead to ongoing enhancement [54]. There must be KPIs to monitor employee involvement, acquisition of skills, and application of competencies in day-to-day operations. Measures can include the count of trained employees, course completion, performance tests, and operational efficiency increases [63]. Additionally, the larger effect of skills development can be measured using citizen-driven indicators, such as timeliness of services, user satisfaction, and the adoption of digital services. Periodic reviews enable organizations to detect lapses and realign training schemes and strategies to suit new technological demands. Meetings with employees and stakeholders, such as surveys, focus groups, and performance reviews, are essential to gaining insights from employees and stakeholders. Ongoing development through repeated evaluation allows organizations to keep digital skills transformation up to date, efficient, and aligned with organizational purposes, while fostering a culture of learning and flexibility in the public sector.

7.4 Change management strategies to address resistance and foster adoption

Change management is an important aspect in the application of digital skills transformation since it deals with human issues that may interfere with adoption. The anxiety about the unknown, an insufficient level of confidence in using digital tools, or the doubt regarding the benefits of transformation is another frequent cause of resistance to change [64]. Organizations need to employ effective change management methods based on communication, engagement, and support to overcome this. The articulation of the vision, goals, and benefits of digital transformation can make employees aware of the intended purpose and results of the initiative. Buy-in and participation are enhanced by engagement strategies, including involving staff in the planning process, getting their feedback, and acknowledging early adopters. It should be ensured that support is provided by means of mentoring, help desks, and peer-to-peer learning, which instills confidence and minimizes anxiety related to the adoption of new technologies [46, 47]. Leadership is also a vital factor in exemplifying digital behavior, supporting good practices, and showing commitment toward the transformation process. By incorporating change management as part of the implementation roadmap, public sector institutions will be able to develop a culture of flexibility, adaptability, and lifelong learning, so that digital skills transformation can be converted into organizational change that has lasting and meaningful effects.

8. Future outlook and recommendations

8.1 Emerging trends in digital governance and skills requirements

The digital governance landscape is changing swiftly due to technological progress, shifting citizen demands, and the growing complexity of the public sector's work. New trends include the integration of AI and machine learning to assist in decision-making, predictive analytics to develop policies, block chain to maintain secure records, and the use of cloud computing to deliver services on a large scale [39]. Such technologies require new competencies, such as data literacy, knowledge of cyber security, understanding of algorithms, and digital project management. Additionally, the emergence of services designed around citizens and mobile solutions necessitates that public sector employees learn to be digital communicators with a solid understanding of user experience and inclusive service delivery [31]. With the increased interconnectedness and data-driven nature of the public sector, it has become imperative to ensure constant adaptation and up-skilling to guarantee that employees can effectively leverage technology to enhance efficiency, transparency, and accountability. With these trends in mind, South African public institutions can actively strategize future skills needs and ensure compliance with global best practices in digital governance.

8.2 Recommendations for policymakers, managers, and educators

Policymakers, managers, and educators need to work together and be strategic in order to bridge the digital skills gap and create transformation. Policymakers should develop elaborate digital skills measures that will be used to establish national standards, allocate funds toward training facilities, and encourage innovation in state institutions. Equitable access to training, especially for those who work in underserved areas, should also be a priority in the policies to minimize differences in digital skills. Managers have a key role to play in operationalizing these policies by integrating digital skills development within performance frameworks, promoting continuous learning programs, and fostering a culture that encourages experimentation and innovation. Trainers and educators are advised to collaborate with public sector institutions to develop context-based curricula that integrate both theoretical and practical knowledge, e-learning, micro-credentials, and experiential fieldwork. By following these suggestions, stakeholders can design an ecosystem that promotes sustainable skills growth, improves organizational performance, and ensures that digital transformation efforts yield tangible outcomes for citizens.

8.3 Long-term vision; building a digitally competent public sector in South Africa

The South African vision for the long-term future of the public sector is the creation of a digitally competent workforce that is able to invent, enhance service delivery, and respond to new technological challenges. This vision encompasses building a culture of lifelong learning in which digital skills are integrated into career building, staffing, and performance appraisal. The main areas that should be invested in by public institutions include technology infrastructure, online platforms, and technology that will allow employees to utilize their competencies in

the most effective way. It will be necessary to collaborate across sectors, that is, involving collaboration with private technology companies, academic institutions, and international organizations in order to gain the latest knowledge and best practices. Finally, a digitally capable government sector boosts efficiency in operations, builds trust among citizens, and positions South Africa to better accommodate the changing demands of digitally driven governance. To attain this vision, it is necessary to have a long-term effort, effective planning, and concerted action by all stakeholders so that the development of digital skills will effectively transform government institutions and society in the future.

9. Conclusion

This chapter has discussed the complex issue of bridging the digital skills gap in the South African public sector and has provided a roadmap toward the transition between training and radical change. It began by placing digital transformation in both a global and South African context and argued that digital skills are absolutely essential for the delivery of services to citizens, fostering innovation, and promoting civic engagement. The chapter outlined the character and magnitude of the digital skills gap, with poor infrastructure, policy constraints, socio-economic inequality, and education being some of the prominent challenges. Other emerging economies have shown that to tackle the skills gap, there needs to be a coordination of efforts, specific interventions, and long-term investment in human capital. The study of existing training programs in this domain identified that there are foundation-based programs regarding digital literacy, but they are constrained by a one-size-fits-all methodology, outdated information, and a lack of practice-based skills. To overcome these restrictions, the chapter presented a transformational conceptual framework, emphasizing the necessity to transform organizational culture, incorporate digital skills into processes, and concentrate on measurable outcomes. The main elements of this change are the commitment of leadership, constant learning, the embracing of innovation, and the development of a digital mentality among employees. By connecting the development of skills to organizational performance and the outcomes for citizens, public sector institutions can ensure that digital competencies are converted into concrete changes in governance, efficiency, and the quality of services offered. The practical strategies to diminish the skills gap, as described in the chapter, include customized training schemes, collaboration between the government and industry, policy responses, the inclusion of e-literacy in hiring and career advancement procedures, and the use of e-learning and micro-credentials. A roadmap for implementation offered a step-by-step plan on how digital skills transformation can be carried out, including risk assessment, M&E, and change management plans to encourage adoption. Lastly, the chapter also reflected on new developments in the area of digital governance and provided policy-makers, managers, and educators with recommendations, stating that in the long term, the creation of a digitally competent, agile, and citizen-focused public sector is the ultimate goal. Finally, the digital skills gap is a technical and strategic necessity that needs to be bridged. To be successful, one must go beyond single-title training programs and adopt a comprehensive change that incorporates skills training, organizational change, and technology adoption. Through the promise of constant learning, the promotion

of innovation, and the integration of skills initiatives with the purpose of public service, South Africa can develop a workforce capable of supporting digital change, enhancing the performance of the public sector, and providing better delivery of services to citizens in an increasingly digital world.

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In today's fast-changing digital economy, organizations face a clear reality: digital tools can create powerful growth opportunities, but only when they are aligned with strategy, capabilities, and responsible decision-making. *Navigating the Digital Economy – Business Strategies for the Future* offers an accessible, practical, and research-informed guide to understanding how digital transformation is reshaping business and society. Bringing together diverse perspectives on digital strategy, analytics-driven decision-making, digital inclusion, platform-based competitiveness, risk management, and capability development, this edited volume highlights what it takes to build resilient and sustainable performance in data-intensive environments. Readers will gain insight into how organizations can use digital innovation to improve customer experience, strengthen operational efficiency, enhance service delivery, and create long-term value, while also addressing critical challenges such as trust, privacy, cybersecurity, unequal access, and skills gaps. Designed for academics, students, managers, policymakers, and professionals, this book supports strategic thinking and practical action by connecting digital disruption with real organizational choices. Key themes include digital transformation, business strategy, analytics, digital governance, customer engagement, financial inclusion, digital infrastructure, organizational capability, and sustainable competitive performance.

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