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DIGITAL COMPETENCY FOR EMPLOYEES IN THE BANKING INDUSTRY: LITERATURE REVIEW

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A B S T R A C T

This study examines how digital skills are developed among banking employees, especially in countries that are still growing their digital systems. Although many models like the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and Diffusion of Innovation (DOI) have been used to study how people adopt technology, the results often differ between developed and developing countries. By reviewing past research, this study identifies the key factors that influence digital skills, such as how useful or easy a technology is to use, support from others, and how well the technology fits user needs. It also shows that in developing countries, trust, digital knowledge, and access to technology are especially important. The study ends by highlighting the need to connect digital transformation with employee skill development, especially in the banking and finance sector.
Keywords: Digital Competency, Technology Adoption, TAM, UTAUT, Banking Industry

Penelitian ini mengkaji bagaimana keterampilan digital dikembangkan di kalangan karyawan perbankan, khususnya di negara-negara yang masih membangun sistem digital mereka. Meskipun berbagai model seperti Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), dan Diffusion of Innovation (DOI) telah digunakan untuk mempelajari adopsi teknologi, hasilnya seringkali berbeda antara negara maju dan negara berkembang. Melalui telaah pustaka, studi ini mengidentifikasi faktor-faktor utama yang memengaruhi keterampilan digital, seperti persepsi terhadap kemanfaatan dan kemudahan penggunaan teknologi, dukungan sosial, serta kesesuaian teknologi dengan kebutuhan pengguna. Penelitian ini juga menunjukkan bahwa di negara berkembang, faktor seperti kepercayaan, literasi digital, dan akses terhadap teknologi memiliki peran yang sangat penting. Studi ini diakhiri dengan penekanan pada pentingnya mengaitkan transformasi digital dengan pengembangan keterampilan karyawan, terutama di sektor perbankan dan keuangan.
Kata kunci: Kompetensi Digital, Adopsi Teknologi, TAM, UTAUT, Industri Perbankan.

INTRODUCTION

The rapid advancement of Information and Communication Technology (ICT) encourages almost all business sectors to adapt quickly. As of 2019, global mobile phone usage reached 6.8 billion users, and approximately 97% of the world's population lives in areas covered by mobile networks (Alalwan, 2020; Molinillo & Ramos, 2018). In Indonesia, the We Are Social and Hootsuite (2021) report explains that 98.3% of internet users own gadgets and 74.7% owning laptops. The development of gadget ownership as part of information and communication technology development provides a new prospective niche for the financial industry, especially in Indonesia.

The era of Industrial Revolution 4.0 brought significant changes in various

sectors, including the banking industry. Changes in people's consumption patterns using digital technology encourage the banking industry to accelerate the transformation process towards digital banking (OJK, 2022). Changes in people's consumption patterns towards digital are increasingly developing with the COVID-19 pandemic. People are increasingly turning to mobile payment systems because they have to avoid physical contact with others, thus forcing the banking world to adopt digitalisation. After the COVID-19 pandemic, a new perspective has emerged regarding the impact and how the world can be connected through information and communication technology (Al-Qudah et al., 2024).

Digital adoption or digitalisation is the implementation of infrastructure and technology in business, economy, or society (Autio, 2017). Digitalisation provides many convenience opportunities but also raises various challenges. Suppose an organisation cannot implement the application and use of technology appropriately and harmoniously. In that case, the organisation will fail to develop and even fail in its efforts to survive (Nikou & Aavakare, 2021). Furthermore, the challenge of digitalisation is not only about how organisations can adopt technology but also how organisations need to redesign the workplace (Colbert et al., 2016). Organizations need to prepare employees to be able to adapt to change and understand the use of technology by accompanying them after digital adoption (Colbert et al., 2016).

Previous studies found that there needs to be agreement between employees and policymakers in the organization in determining the required level of literacy (Colbert et al., 2016). Therefore, organizations not only prioritize strategies in digital adoption but also need to determine strategies on how to improve employee skills in using technology (Kane et al., 2022). Furthermore, employees need to have adequate digital literacy and information literacy skills. The organizations will be successful in adopting digitalization when their employees are digitally ready (Nikou & Avakare, 2021).

Therefore, organizations need to prepare strategies for employees to use technology by ensuring employees have adequate digital literacy and information literacy. It can increase employee success in the workplace and improve overall employee performance. Therefore, digital literacy and information literacy skills can fill the gap between existing digital competencies and the digital competencies needed. Employees in the digital era are not only required to have adequate technological skills but also to be able to adapt to increasingly dynamic changes and developments. required regarding technology in their work (Ahmad et al., 2013). By having adequate digital and information literacy skills, employees will increase their success in building good communication with colleagues, customers, and other stakeholders. This ability is needed as an additional competency where employees who are able to think critically, are creative in solving problems in the work environment, can think analytically, and have adequate verbal communication skills and interpersonal skills are able to increase the success of the organization as a whole (Gekara & Nguyen, 2018). In the banking industry, payment trends are increasingly changing from physical to non -physical, making it necessary for banks to make adaptive efforts by preparing human resources who have strong digital competencies.

Previous research highlights the strategic importance of digital competency in driving organizational transformation and performance within the banking sector. For instance, Kothari et al., (2024) identified digital skills as one of the five critical determinants of successful digital transformation in retail banking, such as: customer experience, service quality, automation, and regulation. Their study, based on empirical data from the United Arab Emirates, demonstrated that digital competency not only supports the adoption of technological solutions but also mediates the relationship between

automation and overall digital transformation, emphasising its pivotal role in aligning technological change with human capabilities. In addition, Santoso et al. (2020) emphasised the urgency of talent mapping in Indonesia's banking and FinTech industries. They identified key future-ready competencies such as adaptability, entrepreneurial thinking, and networking as essential components of digital literacy for navigating Industry 4.0. These findings suggest that to sustain competitive advantage and technological integration, financial institutions must prioritise the strategic development of digital competencies within their human capital frameworks.

This study focuses on the importance of digital competence among banking employees. Although the topic has been widely examined in prior research, findings often show inconsistencies between studies conducted in developed and developing countries. These inconsistencies can be attributed to differences in technological infrastructure, digital literacy levels, socio-economic factors, and cultural attitudes towards technology. For example, Oliveira et al., (2016)found that in Portugal, a developed country, factors such as perceived security, compatibility, and social influence positively impact technology adoption due to a mature digital ecosystem and higher user readiness. In contrast, Abdennebi (2023) reported that in Tunisia, a developing country, challenges like limited digital literacy, weaker infrastructure, and trust issues constrain digital competence and technology adoption despite growing mobile penetration. To overcome these gaps, this research seeks to identify context-specific factors influencing digital competence development in Indonesia's banking sector, emphasising tailored strategies such as enhancing digital literacy, strengthening infrastructure, and building user trust to support effective digital transformation.

LITERATURE REVIEW

Digital technology is defined as a group of technological devices that are powerful, easily accessible, and have the potential to change the game in the fields of social, mobile, storage, analytics, Internet of Things, cognitive computing, and biometrics (Ross, 2017). Previous studies state that the impact of the growth of digital technology is very diverse and significant for organizations (Warner & Wäger, 2019). In digital technology, there are two important dimensions, namely products or services and production and innovation processes which are increasingly unpredictable and increasingly dynamic.

Digital technology includes tools and systems that use digital processes to collect, share, and store information. These technologies are now a key part of how businesses and organizations work. Digital technology gives users new ways to work and solve problems by changing how tasks are done and how people interact with systems (Anderson & Robey, 2017). Kreuzer et al., (2022) explain that digital technology helps businesses find new opportunities by making it easier to connect with customers, use real-time data, and improve products. This shows how digital tools are not just improving existing work, but also creating new ways for businesses to grow and compete.

In the banking and finance industry, digital technology plays a big role in changing how services are delivered. Kothari et al., (2024) found that banks need to focus on digital skills, automation, and customer service to succeed in digital transformation. Santoso et al., (2020) also highlighted that employees need to be flexible, creative, and good at building networks to make the most of digital technology. These studies show that successful use of digital tools depends not only on having the right technology but also on preparing employees and adjusting business strategies to support digital change.

For customers, using digital tools like mobile payment apps depends on how useful, easy, and safe they feel those tools are. Jaiswal et al. (2022) showed that users are likelier to keep using mobile wallets if the apps meet their expectations and are

easy to use. Similarly, Al-Qudah et al., (2024) found that people's skills in using digital tools and their beliefs about usefulness and convenience influence whether they will use mobile payments. Molinillo & Ramos (2018) also noted that age and situation, such as being on vacation, can affect how people use digital payments. These findings show that even the best technology must be user-friendly and meet people's needs to be successful.

Digital transformation is a continuous process where organisations use digital technologies to improve operations, services, and business models. This process requires the adoption of new tools and significant changes in how organisations think and work. As Warner & Wäger (2019) explain, digital transformation involves constant adaptation, where leadership, culture, and strategy must align with technological change. However, the wide range of digital platforms used across organisations can lead to different results depending on their application. Nambisan (2017) points out that digital technologies allow other users to apply the same tools differently, depending on their goals and understanding. While useful, this flexibility can also create challenges, especially when employees lack the skills to fully use digital systems. For this reason, digital competence is essential. It helps individuals recognise the opportunities technology offers and use it effectively in their work. Developing these competencies within the organization is a key part of ensuring that digital transformation efforts succeed.

Digital competency refers to the combination of skills, knowledge, and attitudes needed to use digital tools effectively in various settings. Along with the rapid development of technology, digital competency has become an essential factor for both individual success and organizational performance. Colbert et al., (2016) emphasized that digital transformation changes how people work and demands new skill sets from employees. Gekara & Nguyen (2018) also highlighted that automation and digitalization require a mix of technical and soft skills that can be applied across different job roles. Murawski & Bick (2017) added that digital competency is not only about knowing how to use technology, but also about adapting to cultural and structural changes within organizations. These findings show that digital competency is multidimensional—it includes technical literacy, critical thinking, adaptability, and the ability to learn continuously. In a digital environment, employees must be able to use tools effectively, navigate change, and support innovation.

In the banking sector, digital competency has become a critical element for maintaining service quality and operational efficiency. As banks shift from conventional to digital systems, employees are expected to operate advanced digital platforms, support automation, and enhance customer experience. According to Kothari et al., (2024), digital skills are one of the five most important things that directly support successful digital change. The other four are automation, customer experience, service quality, and regulation. Employees with strong digital competencies are better able to engage with new technologies, reduce processing time, and improve customer satisfaction. Warner & Wäger (2019) also emphasized that digital transformation is not merely about adopting technology, but also about aligning people and processes to ensure successful change. Therefore, digital competency is not just a personal asset but a strategic organizational need in the modern banking environment.

Digital competency in banking is also closely linked to talent management and the development of future-ready employees. Santoso et al., (2020) conducted a talent mapping study in Indonesia's banking and FinTech sectors and found that most organizations face a gap between current employee capabilities and the competencies needed for digital roles. They identified adaptability, networking, and commercial thinking as critical areas to address. Cetindamar Kozanoglu & Abedin (2021) reinforced this by conceptualising digital literacy as a form of organisational

capability that supports system use, knowledge sharing, and innovation. Similarly, Nikou & Aavakare (2021) showed that information and digital literacy help employees adjust to digital environments and use technology effectively. These studies suggest that to remain competitive, banks must invest in continuous learning, upskilling programs, and digital talent strategies that align with the evolving digital landscape.

Besides being internal readiness, digital competency in banking also influences how well institutions engage with and support customers in using digital services. As more customers adopt mobile and online banking, employees must be equipped to operate these systems, guide users, and resolve technical issues. Patel & Patel (2018) found that customer adoption of internet banking is strongly influenced by ease of use, usefulness, and perceived security. Al-Qudah et al. (2024) further highlighted that user skillfulness, convenience, and trust significantly affect mobile payment adoption. These findings suggest that front -line banking staff must possess the digital skills to enhance user experience, build trust, and promote confidence in digital channels. Most importantly, digital competency supports internal transformation and the bank's ability to deliver reliable, secure, and user-friendly digital services to customers.

Digital competency means having the skills, knowledge, and attitude needed to use digital tools effectively. Many studies show that digital competency is important in helping people adjust to new technology and support changes in how organisations work. For example, Colbert et al., (2016) explained that technology is changing job roles and that workers need to learn new skills to succeed. Gekara & Nguyen (2018) found that as machines and automation become more common, workers need a mix of digital and soft skills to keep up. Murawski & Bick (2017) also said that having digital skills helps workers become more ready for the job market. In another study, Chao (2019) showed that people are more likely to use digital tools if they find them useful, easy to use, and if they trust the system. Nambisan (2017) added that digital platforms help people be more creative and take action in uncertain situations. These studies show that digital competency is a mix of technical and thinking skills that are important for success in today's digital world.

RESEARCH METHODS

This research uses a literature review to explore the theoretical foundations, key variables, and antecedents of digital competency, focusing on the banking industry. This literature review aims to synthesise existing academic work related to digital competence, digital literacy, and the digital transformation of financial institutions, in order to map out key constructs, commonly used theoretical frameworks, and methodological trends. This research was prepared by conducting a content analysis of previous scientific research articles. The article selection process used as the basis for preparing this research is based on reputable international journals published during the last five years (2020 – 2024). This process is carried out by searching for scientific articles on the Science Direct website using the keywords "digital competence", "digital literacy", "banking industry", and "antecedents".

The selection of articles from the Science Direct website was done because Science Direct is always affiliated with the Scopus library. First, we used the keywords "digital competence", "digital literacy", and "antecedents" in search engines in the 2020 -2024 time period and produced 3419 related articles. Second, we limited the search by adding the keyword "banking industry", which resulted in 413 related articles. Researchers also added filters in the search process, such as only selecting reviews and research articles and limiting subject areas to Business, Management, and Accounting. Further analysis was carried out on these articles to answer theoretical questions and antecedents of digital competence, especially for the banking industry. In addition, researchers also included other relevant international articles published before 2020 to

Table 1.
Theoretical Frameworks and Models for Analysing Technology Adoption

No	Reference	Theory	Description	Research Variables	Main Findings
1	Rogers (1995)	Theory of Diffusion of Innovations	Explains how innovations spread within a social system based on attributes such as relative advantage, compatibility, complexity, trialability, and observability.	Relative Advantage, Compatibility, Complexity, Trialability, Observability	Diffusion is influenced by both the perceived attributes of the innovation and social system dynamics.
2	Ajzen and Fishbein (1985)	Theory of Reasoned Action	Explains how an individual's intention to perform a behavior is influenced by their attitude toward the behavior and the perceived social pressure (subjective norm).	Attitude toward behavior, Subjective norm, Behavioral intention	Behavioral intention is a strong predictor of actual behavior, shaped by individual attitudes and social expectations.
3	Ajzen (1991)	Theory of Planned Behaviour	Extends the Theory of Reasoned Action by adding perceived behavioral control as a key determinant of intention and behavior.	Attitude, Subjective Norm, Perceived Behavioral Control, Intention, Behavior	Behavior is directly influenced by behavioral intention and perceived control over the behavior.
4	Davis (1989)	Technology Acceptance Model	Explains user acceptance of technology based on two main factors: perceived usefulness and perceived ease of use.	Perceived Usefulness, Perceived Ease of Use, Attitude Toward Use, Behavioral Intention, System Use	User perceptions significantly predict acceptance and usage behavior of technology systems.
5	Venkatesh et al., (2003)	Unified Theory of Acceptance and Use of Technology	Integrates elements from eight prior models to identify key predictors of technology acceptance: performance expectancy, effort expectancy, social influence, and facilitating conditions.	Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions	Core constructs effectively predict behavioral intention and use across contexts; moderating variables like age, gender, and experience play roles.

strengthen and deepen the theoretical discussion and analysis.

ANALYSIS AND DISCUSSION

Various theoretical frameworks have been extensively developed and applied in academic literature to better understand the factors influencing technology acceptance and adoption, especially in the context of developing digital competency within the banking industry. These theories offer conceptual foundations for explaining how individuals form attitudes, intentions, and behaviours toward new technologies. Each theory highlights different dimensions, such as perceived usefulness, ease of use, social influence, behavioural control, and innovation characteristics, that shape the rate and success of technology adoption. The following list presents several key theories that serve as the theoretical basis for analysing technology adoption and the diffusion of innovation, with the articles listed below representing the main theoretical references used in this study.

In addition to understanding the theoretical foundations, it is also important to examine how previous research has used independent and dependent variables to study digital competency and technology adoption. Across the literature, the most common independent variables include perceived usefulness, perceived ease of use, performance expectancy, effort expectancy, social influence, trust, and innovation characteristics such as relative advantage and compatibility (Davis, 1989; Rogers, 1995; Venkatesh et al., 2003.). These variables are often used to predict dependent variables such as behavioural intention to use, actual usage of a system, user satisfaction, or the level of digital competency (Ajzen, 1991; Venkatesh et al., 2003).

Each theoretical model places emphasis on different predictors. For example, the Technology Acceptance Model (TAM) focuses on perceived usefulness and ease of use as the main drivers of technology adoption (Davis, 1989). The Diffusion of Innovation (DOI) theory emphasises the role of innovation attributes like compatibility and observability (Rogers, 1995). Meanwhile, the Unified Theory of Acceptance and Use of Technology (UTAUT) brings together multiple predictors—including social influence and facilitating conditions—while also considering demographic factors such as age, gender, and experience as moderators (Venkatesh et al., 2003).

There is an ongoing debate in the literature regarding which variables are most relevant depending on the context. In developing countries, for example, factors like trust, digital literacy, and infrastructure support tend to have a greater influence compared to developed countries with more mature digital ecosystems (Abdennebi, 2023; Oliveira et al., 2016). Therefore, researchers often modify or extend existing models by adding these context-specific variables to better explain adoption behaviour (Al-Qudah et al., 2024; Chawla & Joshi, 2019).

Mapping findings from past studies reveals that while some predictors, such as perceived usefulness and performance expectancy, are consistently significant, others vary depending on the setting. This highlights the need for future research to adopt more flexible and context-aware approaches when analysing digital competency, especially in the banking sector of developing economies.

Given this consideration, this study will discuss TAM, UTAUT, and DOI as the most widely used theories, particularly in examining digital competency within the banking industry. These theories provide essential insights into the factors influencing technology adoption and help explain the success of digital transformation initiatives in this sector.

Theory Acceptance Model (TAM)

The Technology Acceptance Model (TAM), introduced by Davis (1989), is one of the most influential frameworks for predicting and explaining user behaviour toward adopting new technologies. The model is based on two primary constructs: perceived usefulness (PU), which refers to the degree to which a person believes that using a system will enhance their job performance,

and perceived ease of use (PEOU), defined as the degree to which a person believes that using the system will be free of effort. These perceptions affect a user's attitude toward using the system, influencing their intention and actual usage.

Chawla & Joshi (2019) applied TAM, along with elements of the Unified Theory of Acceptance and Use of Technology (UTAUT), to study the adoption of mobile wallets in India. Their findings showed that PU, trust, and security significantly influenced consumers' attitudes and intentions to adopt mobile wallets. Interestingly, perceived ease of use and lifestyle compatibility were insignificant among politically literate respondents, indicating that user background and experience can influence the relevance of specific TAM constructs. In addition, Patel & Patel (2018) examined the adoption of internet banking in Gujarat using TAM. They found both PU and PEOU to be significant predictors of intention to adopt, with trust playing a critical mediating role. Their results emphasise the model's applicability in financial technology and highlight the importance of building user

Table 2.
Digital Competency Research Topics in the Last Five Years (2017-2021)

No	Reference	Theoretical Framework	Research Variables	Main Findings
1	Chawla & Joshi (2019)	Technology Acceptance Model (TAM) & Unified Theory of Acceptance and Use of Technology (UTAUT)	Awareness Level, Age Group, Perceived Usefulness, Trust, Security, Lifestyle Compatibility, Perceived Ease of Use, Facilitating Conditions, Attitude	Lifestyle compatibility significantly influences adoption; Perceived ease of use and lifestyle not significant among politically literate users.
2	Al-Qudah et al., (2024)	Technology Acceptance Model (TAM)	Skillfulness, Perceived Risk, Convenience of Systems, Perceived Usefulness, Intention to Use	User skillfulness enhances perceived usefulness; risk perception negatively affects intention to use.
3	Al-Okaily et al., (2020)	Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)	Intention to Use, Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Price Value, Awareness, Security, Privacy, Subjective Norm, Peer Influence, Cultural Values	Performance expectancy influences intention to use; effort expectancy and facilitating conditions are not significant.
4	Nikou & Aavakare (2021)	Technology Acceptance Model (TAM)	Information Literacy, Digital Literacy, Perceived Ease of Use, Perceived Usefulness, Attitude, Intention to Use Technology	Digital and information literacy explain a large portion of variance in digital technology use at the workplace.
5	Huang et al., (2024)	Diffusion of Innovation Theory (DOI)	Innovation Attributes (Relative Advantage, Compatibility, Complexity, Trialability, Observability), Communication Channels, Social System	Innovation diffusion occurs in five stages and is influenced by how individuals perceive the innovation and by social and communication factors; DOI remains relevant across sectors including health, education, and digital environments.

confidence when implementing digital banking services.

A systematic review by Rosli et al. (2022) found that while PU and PEOU remain central to TAM-based studies in higher education, researchers have increasingly added external variables such as digital infrastructure, user satisfaction, and facilitating conditions to adapt TAM to specific technological contexts, especially during the COVID-19 pandemic. These extensions demonstrate the model's flexibility and its evolving use across disciplines. In the other hand, Abdennebi (2022) reviewed TAM applications and pointed out that although PU and PEOU provide a solid foundation, their overuse without contextual adjustments can reduce the model's explanatory power. He emphasised the importance of incorporating external variables such as digital literacy, institutional support, and cultural dynamics to make the model more robust and relevant in modern digital settings.

Gupta et al. (2022) also highlighted that institutional and social contexts significantly affect TAM constructs. Their study on digital learning adoption during the pandemic showed that perceived usefulness and intention to use are strongly influenced by peer support, administrative backing, and platform accessibility. Similarly, Myers et al. (2016), in their study of organisational identification, underscored how students' alignment with institutional values and communication environments can shape their behavioural responses, factors that complement TAM's user-centric orientation by incorporating relational and contextual dynamics.

In summary, TAM remains a widely adopted and adaptable model. While its core constructs continue to offer predictive strength, recent literature suggests that TAM yields the best results when enhanced with contextual, psychological, and organisational variables. This balance between theoretical simplicity and practical flexibility makes TAM especially valuable in studying the adoption of technologies across diverse sectors.

Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT), introduced by Venkatesh et al. (2003), integrates constructs from eight earlier models to explain technology acceptance. It identifies four core predictors: performance expectancy, effort expectancy, social influence, and facilitating conditions, which influence behavioural intention and usage behaviour. These relationships are further moderated by individual factors such as age, gender, experience, and voluntariness of use (Dwivedi et al., 2019). The model has been widely validated and applied across finance, education, and government services. In a comprehensive review, Tamilmani et al. (2021) found that performance expectancy consistently emerged as the strongest determinant of behavioural intention. Effort expectancy and social influence were also significant in many studies, though their impact varied by user demographics and technology type. For instance, Chawla & Joshi (2019) used UTAUT to explore mobile wallet adoption in India and found that in addition to the original constructs, variables like lifestyle compatibility, trust, and security played critical roles in influencing users' intention to adopt.

The model's relevance in the public sector is illustrated in research by Neves et al., (2025), who applied UTAUT to analyse digital service adoption in Portugal. Their study found that facilitating conditions and effort expectancy had greater influence on older or less digitally literate users. This suggests that organisational support and ease of system use are essential for increasing adoption in public-facing platforms, especially in regions with varying technological exposure and infrastructure levels. Liu & Wang (2023) expanded UTAUT by incorporating trust and perceived risk in an online learning platform adoption study. They reported that trust had a substantial positive impact on both performance expectancy and effort expectancy, while perceived risk negatively influenced behavioural intention. Their

findings highlight that trust becomes a key driver of technology acceptance when data privacy or system reliability is a concern, such as in digital learning or banking. Wang et al., (2022)conducted a bibliometric review of UTAUT research in higher education and noted that recent studies often integrate additional organisational variables like digital readiness and institutional support. They also observed growing interest in constructs such as habit and system quality, which are used to refine the predictive accuracy of UTAUT in academic environments where both personal and institutional factors influence usage behaviours.

According to Dwivedi et al. (2019), UTAUT remains a powerful tool for understanding technology adoption, especially when adapted to sector-specific needs. Extending the model with context-relevant variables such as digital literacy, culture, or system trust enhances its explanatory power and relevance in modern digital transformation initiatives.

Diffusion of Innovation (DoI) Theory

The Theory of Diffusion of Innovations (DOI) by Rogers (1995) provides a foundational framework for understanding how new ideas and technologies spread within a social system. It highlights five key innovation attributes—relative advantage, compatibility, complexity, trialability, and observability—that influence the rate and extent of adoption. Building on this framework, Aizstrauta et al., (2015) applied these attributes in developing the IASAM2 model (Improved Alternative Sustainability Assessment Model 2), a simulation-based evaluation tool designed to assess technology acceptance and sustainability without relying on subjective user surveys. This model enables broader and more efficient assessments during early technology development stages. Further extending the applicability of DOI, Takahashi et al. (2024) investigated the diffusion of deep learning innovations by examining sequential adoption patterns across public interest (search trends), technological implementation (patents), and academic attention (publications). Their findings suggest that innovation diffusion unfolds in distinct but interconnected phases, reinforcing the relevance of DOI in analysing not only user behaviour but also the broader systemic and temporal dynamics of technological uptake.

Application of theory in research related to the banking industry

The Technology Acceptance Model (TAM), initially developed by Davis in 1989, has remained one of the most influential and widely adopted frameworks in information systems research. It has been applied across various disciplines to understand user acceptance of new technologies, particularly in contexts involving digital tools and platforms. TAM has served as a foundational theory for analysing customers' behavioural intentions toward digital banking services in the banking industry. Patel and Patel (2017) employed TAM to identify key factors influencing customer intention to adopt internet banking in Gujarat, extending the model by including perceived security and social influence, with perceived security found to be the strongest predictor. Similarly, Al-Qudah et al. (2022) applied TAM to examine mobile payment adoption, especially the Apple Wallet app, in the UAE's banking ecosystem, highlighting the significant roles of user skillfulness, convenience, and perceived usefulness. Expanding on TAM, Abdennebi (2023) integrated trust, security, and satisfaction constructs to investigate mobile banking adoption in Tunisia, emphasising how these variables mediate the relationship between perceived ease of use, usefulness, and user intention.

TAM has been extensively used in the banking industry to evaluate the adoption of technology-based innovation, particularly as financial institutions shift toward digital service delivery. The model is a robust foundation to assess users' acceptance of internet banking, mobile payments, and other digital financial tools by emphasising user perceptions, trust, and usability. Its continued relevance in the banking industry lies in its flexibility to

accommodate context-specific extensions and its strong explanatory power in predicting technology use behaviour.

The Unified Theory of Acceptance and Use of Technology (UTAUT), introduced by Venkatesh et al. (2003), has become a widely used framework for studying technology adoption, particularly in the banking sector. Since its introduction, the model has been applied across various digital services, helping researchers explain user behaviour related to internet banking, mobile banking, and digital payments. Specifically, several studies have applied the original UTAUT model to explore user intentions in banking services. For example, Venkatesh et al. (2003) laid the foundation for using UTAUT in internet and mobile banking. Similarly, Martins, Oliveira, and Popovic (2014) applied UTAUT to evaluate internet banking adoption, incorporating perceived risk as a key explanatory factor. Similarly, Al-Okaily et al. (2020) used the UTAUT model to study digital payment adoption, focusing on performance expectancy and security factors.

In addition to these applications, some researchers have modified or extended the UTAUT model to reflect real-world adoption behaviour better. For instance, Dwivedi et al. (2017) revised the model by adding attitude as a predictor, improving its explanatory power in understanding information system usage, including within banking. Furthermore, Liu et al. (2019) highlighted UTAUT's adaptability, suggesting that its constructs remain relevant across various digital services, including fintech platforms. Likewise, Jaiswal et al. (2022) used UTAUT to examine the initial adoption and continued use of mobile wallets in India. Moreover, other studies have employed UTAUT2, an extended version of the original model, to capture consumer behaviour more comprehensively. For example, Tamilmani et al. (2021) provided a systematic review of UTAUT2's use in mobile banking, emphasising the importance of hedonic motivation and price value. Additionally, Al-Okaily et al. (2020) applied UTAUT2 to investigate the adoption of mobile payment services in Jordan, integrating additional variables such as awareness, privacy, and cultural factors. Meta-analytic work by Dwivedi et al. (2019) has further reinforced UTAUT's validity in information system or information technology adoption, including in the banking sector, and highlighted how contextual factors, such as culture, can influence the strength of predictor variables.

While UTAUT has become one of the most widely used frameworks to study technology adoption in banking, another influential model, the Diffusion of Innovation Theory (DOI), offers complementary insights by focusing on how innovations spread across individuals and organisations over time. The Diffusion of Innovation Theory (DOI), developed by Everett Rogers in 1962, has become one of the most influential frameworks for studying how innovations spread across societies and industries. Over the decades, DOI has been widely applied to research across healthcare, agriculture, education, and more recently, digital financial services. Its relevance has grown even stronger in the digital era, as industries aim to understand how individuals and organisations adopt innovations. Several studies have applied DOI to examine the adoption of digital technologies in the banking industry. For example, Kothari, Grandhi, and Thrassou (2024) used DOI to explore how digital transformation in retail banking is shaped by customer experience, service quality, and digital skills, helping banks achieve their strategic goals. In another study, Kothari, Grandhi, and Thrassou (2024) explained how the diffusion of digital innovations in retail banks tends to follow a pattern, focusing on the roles of service quality, customer experience, and automation in digital adoption. Additionally, Aizstrauta et al. (2015) applied DOI to evaluate technology acceptance and sustainability, offering a framework to assess digital competency development in organizations by considering attributes such as relative advantage and complexity.

More broadly, DOI has become an

important framework for understanding innovation adoption in the banking sector, particularly in the digital era. For instance, Takahashi et al. (2024) indirectly applied DOI by analysing the takeoff of fintech innovations through patent analysis and assessments of technological readiness among financial institutions. Overall, DOI helps researchers and practitioners understand the dynamics behind the spread of innovations, enabling banks to design better strategies for digital transformation, improve customer experience, and strengthen service quality. As digital technologies continue to reshape the banking landscape, DOI remains a valuable tool for guiding both research and practice.

Specifically in Indonesia, the study by Santoso et al. (2020) applies the Talent Mapping and Competency Framework to assess current and future competencies in the banking and FinTech industries. Using a mixed-method approach that combines surveys and focus group discussions, the research identifies key skills such as entrepreneurial thinking, adaptability, and networking as critical for navigating digital transformation. The study highlights that while digitalisation in Indonesia's financial sector is rapidly advancing, it is not yet matched by sufficient human capital preparedness. As a result, the study provides valuable insights for policymakers and industry leaders, emphasising the importance of developing talent strategies aligned with Industry 4.0 demands. By mapping competencies using methods like the analytic hierarchy process (AHP) and quadrant analysis, this research offers a clear roadmap for strengthening digital capabilities and supporting Indonesia's transition toward a more inclusive and competitive digital economy. Unlike studies that rely on TAM, UTAUT, or DOI to analyse technology adoption behaviours, Santoso et al. (2020) focus on the organisational and human resource dimensions of digital transformation, making use of the Talent Mapping and Competency Framework as the main theoretical foundation rather than traditional technology acceptance models.

The Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and the Diffusion of Innovation Theory (DOI) have all become essential frameworks for understanding digital competency in the banking industry. TAM focuses on perceived usefulness and ease of use, helping explain why customers and employees accept new digital tools. UTAUT builds on this by adding factors such as performance expectancy, effort expectancy, social influence, and facilitating conditions, making it highly relevant for studying the adoption of services like mobile banking and digital payments. Meanwhile, DOI provides a broader perspective by examining how innovations spread over time among individuals and organisations, focusing on factors like relative advantage, compatibility, and complexity. Together, these theories offer a comprehensive understanding of how digital transformation is adopted and sustained in the banking sector, helping improve customer experience, service quality, and innovation strategies.

CONCLUSION AND IMPLICATION

In conclusion, this study highlights the critical role of digital competency in the banking industry, particularly as digital transformation continues to accelerate. Through a comprehensive literature review, we explored the key theoretical frameworks TAM, UTAUT, and DOI, which have been widely used to analyse technology adoption and the factors influencing digital competency. These models provide valuable insights into the individual and organisational factors that drive successful digital transformation in the banking sector. Furthermore, the research emphasises the importance of aligning technological adoption with human capital development, as demonstrated by the study of Santoso et al. (2020), which highlights the need for talent mapping and the strategic development of digital skills in Indonesia's banking and FinTech sectors. Ultimately, the findings of this study call for continued research to address gaps in digital competency, especially in developing countries, and to

explore the integration of new variables and frameworks to support the growing demands of digital transformation in financial services.

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