



# Factors Influencing Digital Technologies Adoption among Indonesian SMEs: A Conceptual Framework

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**Abstract.** Although digital technologies have ascended and many firms have adopted them into their system, Small and Medium Enterprises (SMEs) have been reported for lagging behind their larger counterparts in digital technology adoption. This paper identifies factors that influence digital technology adoption among SMEs by comprehensively reviewing the relevant literature and proposing a conceptual framework. Therefore, this paper adopts the Technology, Organisation, and Environmental (TOE) framework complemented by Roger's Diffusion of Innovation (DOI) theory as its theoretical lens to reveal critical factors leading to digital technology adoption among Indonesian SMEs. In total, there were thirteen independent variables to measure the digital technologies adoption by SMEs from the TOE framework. e.g., adoption costs, perceived benefits, compatibility, complexity, perceived security, top management support, human resources, digital culture, international orientation, government regulatory support, government resource support, trading partner pressure, and competitive pressure.

**Keywords:** Digital Technologies, Small and Medium Enterprises, Technology, Organisation, and Environmental (TOE).

## 1 Introduction

Innovation has aided firms in achieving competitive advantage and a dominant position in the market. Its significance is reinforced by rising global competition and the firm's increased technological capabilities. Among innovation categories, digital technology has played a quintessential innovation decisive role in enhancing firms' productivity. Digital technology has provided better access to skills or talent and expanded market share (OECD, 2017). Digital technology has assisted firms in developing new products, services, or management (Skare & Riberio Soriano, 2021), promoting efficiency through better communication and collaboration, thereby providing a competitive advantage to the firms (Ramdani, Raja, & Kayumova, 2022). Thus, many firms have integrated technological innovation into their systems to harness the benefits of digital technologies to transform their business operation. As a result, adopting digital technologies has changed how firms and consumers engage and exchange value, leaving the traditional trading practice (Ferreira, Fernandes, & Ferreira, 2019).

Digital technologies have grown, and many firms have adopted them into their systems. Small and Medium Enterprises (SMEs) have been reported to lag behind

their larger counterparts in adopting digital technologies, even for emerging technologies relevant to SMEs (OECD, 2017; Ramdani et al., 2022). Factors that affect the adoption of digital technologies between large firms and SMEs might not be the same as those constrained with knowledge and financial resources, restricting their ability to capture the benefits of the digital economy (OECD, 2017; Eller, Alford, Kallmünzer, & Peters, 2020). Notwithstanding this fact, studies focusing on digital technology uptake among SMEs remain limited as studies in this field mainly were geared toward understanding digital technology adoption in large firms (Roffia & Mola, 2022). The lagging digital technologies engagement might be even worse in developing countries' SMEs (Akpan, Udoh, & Adebisi, 2022). SMEs in developing countries conceivably face more issues than SMEs in developed countries. Consequently, SMEs' digital technologies uptake in developing countries is generally lower than their counterparts in developed countries (e.g., Hamad et al., 2018; Susanty et al., 2020; Akpan et al., 2022).

The COVID-19 pandemic might spur (or, indeed, have already produced) this transformation further because customers were taking the precautionary approach of avoiding going out, as the World Health Organisation suggested, to prevent virus transmission (De', Pandey, & Pal, 2020). A recent study found that firms having higher turnover during COVID-19 have been associated with using digital technologies in their business operation (Trinugroho, Pamungkas, Wiwoho, Damayanti, & Pramono, 2022). However, with the drastic circumstantial changes emanating from the COVID-19 pandemic, the current literature may not cover the most relevant factors affecting digital technology adoption, and research that covers these issues is undoubtedly warranted (Kumar, Lim, Pandey & Christopher Westland, 2021; Akpan et al., 2022).

This paper critically analyses the relevant literature on digital technology adoption and suggests a conceptual framework to determine the influencing factors for adoption among SMEs.

**1.1 Indonesian Context**

The government of Indonesia classifies SMEs into three categories, small, medium, and micro enterprises, based on yearly turnover and value of assets, all of which are stipulated in Indonesian Law No. 20/2008, as presented in Table 1 below. A firm must satisfy both conditions (value of assets and annual turnover) to be considered an SME.

**Table 1.** Indonesian SMEs by category.

No	Category	Value of Assets (IDR)	Annual Turn Over (IDR)
1	Micro Enterprises	0-50 Million	0-300 Million
2	Small Enterprises	50-500 Million	300 Million – 2.5 Billion
3	Medium Enterprises	500 Million – 10 Billion	2.5-50 Billion

Source: Indonesian Law No. 20/2008

The Ministry of Cooperative and Micro, Small and Medium Enterprises [MCMSME] (2021) reported that 99.9 percent of all enterprises in Indonesia were SMEs, absorbing almost 97 percent of the Indonesian workforce and contributing more than 60% of the country's GDP in 2019. Therefore, SMEs play a dominant role

in Indonesian economic activities and a paramount role in the country's economic development.

Digital technology adoption among Indonesian SMEs is considered low for a country with 70 percent of its population connected to the Internet (Statista, 2020). Statistic Indonesia (2021) revealed that only 15 percent of Indonesian SMEs have ventured into digital technology platforms, while the remainder is still engaged with the conventional method. This situation may threaten Indonesian SMEs as most large enterprises are involved with digital technologies. Essentially, digital technologies can help SMEs develop and maintain competitive strategies, laying the groundwork for long-term advancement and market dominance (Akpan et al., 2022). Indonesian SMEs can compete with larger enterprises by adopting the necessary digital technology.

## 1.2 Theoretical background

The decision to adopt digital technology is considered a complex issue, wherein the factors that influence such adoption originate not only from the adopters' sides but also from a broader spectrum of business environments involving customers, suppliers, competitors, and government (Sanchez-Torres & Juarez-Acosta, 2019). Therefore, it is critical to pinpoint the determinants of digital technology adoption among SMEs from the literature to understand the mechanism of such adoption better. This paper adopts the Technology, Organisation, and Environmental (TOE) framework developed by Tornatzky and Fleischer (1990) as a guideline to identify the structures underpinning the factors that affect digital technology adoption among SMEs from the literature. Due to the number of factors that may either prevent or promote SMEs' adoption of digital technology from the extensive literature, the application of the TOE framework should help classify them into specific categories (Awa, Ojiabo, & Orokor, 2017).

The TOE framework postulates several factors to predict the likelihood of particular innovations, namely technological, organizational, and environmental (Tornatzky & Fleischer, 1990). Technical factors are the technology's characteristics, which affect firms' decisions to adopt digital technology, such as adoption costs, perceived benefits, perceived risks, compatibility, and complexity of technological innovation. Organizational factors are inextricably linked to and controlled by firms, such as human resources and the size of firms. Meanwhile, environmental factors are characterized as factors arising outside firms' spheres, such as pressure from competitors or suppliers and government support (Baker, 2012; Awa, Ukoha & Igwe, 2017). The TOE framework is considered a quintessential framework for revealing factors. The TOE framework promotes or inhibits IT-related adoption among firms as its three dimensions cover all factors that make technology adoption successful and have been utilized as a theoretical lens in many IT-related research efforts (e.g., Oliveira et al., 2019; Sila, 2019; Abed, 2020; Chau, Deng, and Tay, 2021).

Furthermore, to complement the TOE framework, this paper integrates Roger's Diffusion of Innovation (DOI) theory (Rogers, 2003) as its theoretical lens. DOI is chosen because its constructs are identical to the TOE, except for the environmental context (Oliveira et al., 2019; Ahmad, Abu Bakar, & Ahmad, 2019). In the latest journal have concluded and underscored that the combination of the TOE framework and DOI theory should provide a comprehensive framework for revealing critical factors leading to technology adoption among SMEs, especially in emerging

economies (e.g., Ilin, Ivetić, & Simić, 2017; Chau, Deng, and Tay, 2020). The DOI's mechanism emphasizes technological characteristics as drivers of technology adoption and appears to be more focused on the process of technology diffusion within firms. At the same time, TOE encompasses internal and external factors contributing to firms' technology adoption (Awa, Ukoha et al., 2017). Given that technological characteristics highly influence the decision to adopt technology among small firms, the application of DOI would bolster TOE and provide a more detailed perspective of technology adoption (Chau et al., 2020).

## 2 Literature Review

The following section discusses the technological, organizational, and environmental elements influencing digital technology adoption among SMEs, as identified in the extant literature.

### 2.1 Technological context

**Adoption Costs.** The cost of acquiring new technology is reported as the major impediment to firms' ability to engage with technology innovation (Valmohammadi & Dashti, 2016), let alone for SMEs who are inevitably confronted with resource constraints (Eller et al., 2020). Although some scholars argue that digital technologies have become more affordable (e.g., Chau et al., 2021), some evidence suggests that adoption costs are still regarded as a barrier for SMEs to engage with digital technologies (Ghobakhloo, Iranmanesh, Vilkas, Grybauskas, & Amran, 2022). For instance, digital technologies incur high costs due to the technology acquisition, such as hardware and software costs, underlying systems, maintenance costs, hiring IT specialists, and consultation with experts (Mohtaramzadeh, Ramayah, and Jun-Hwa, 2018; Ali, Chung, Kumar, Zailani, & Tan, 2021; Mkansi), where the higher the adoption costs, the more unlikely the adoption (Valmohammadi & Dashti, 2016). Hence, SMEs are more likely to be cautious before adopting digital technology to ensure they do not make a poorly considered decision; therefore, when they believe that digital technology adoption is not worthwhile, they might choose not to do so (Ghobakhloo & Ching, 2019).

**Perceived benefits.** Iacovou, Benbasat, and Dexter (1995) defined perceived benefits as the degree of acceptance to which an organization accepts the potential benefits of technology adoption. Perceived benefits have been examined in several IT-related research subjects. They have been indicated as the chief determinant of the pace of technology adoption by large firms (e.g., Chatzoglou & Chatzoudes, 2016) and SMEs (e.g., Susanty et al., 2020). Kurnia et al. (2015) explained that firms are more likely to adopt new technology if they conceive that adopting it would benefit them. Digital technology offers various benefits for the adopters, including extending their market reach, increasing sales, improving external communication, company image, speed of data processing, and employee productivity (Skare et al., 2021; Ramdani et al., 2022; Ghobakhloo et al., 2022). Some scholars posited that the low perception of digital technology benefits had been regarded as the major impediment to digital technology, while the higher their perception of digital technology benefits, the greater the

possibility of adoption due to the adoption of new technology is usually based on commercial benefit (Susanty et al., 2020; Swani, 2021).

**Compatibility.** Compatibility is one of the terms used by Rogers in the Diffusion of Innovation Theory (Rogers, 2003). In the field of technology adoption, compatibility is defined as the degree to which the adoption of a particular technology is congruent with firms' earlier practices, including how the technology in question fits with their existing technologies, cultures, and business practices (Kurnia et al., 2015; Awa, Ukoha, et al., 2017). The reason why compatibility has been cited as a determining factor in the adoption of new technology can be explained by the fact that firms demand the assurance that the value of the technology can be accepted by their current business practices and conform with other entities within the distribution chain, ensuring that the adoption will not ultimately be futile (Chatterjee & Kumar Kar, 2020). Various studies found compatibility as the driver of digital technology adoption among SMEs (e.g., Singh & Sinha, 2020; Chau et al., 2021). The higher levels of compatibility of digital technology have been associated with higher levels of digital technology adoption (Shaltoni, West, Alnawas, & Shatnawi, 2018). In contrast, the incompatibility of digital technology with SMEs' current systems has discouraged them from adopting new technology (Moghavvemi, Mei, & Phoong, 2021).

**Complexity.** Complexity is the level of the individual's perception of an innovation's ease of use or integration. Essentially, this perception is inversely proportional to the possibility of adopting the innovation (Rogers, 2003). The term 'complexity' in Roger's DOI is synonymous with 'perceived ease of use' in TAM (Moore & Benbasat, 1991). The more efficiently the technology can be applied by an organization, the more likely they are to engage with such technology. In reverse, the more complex the technology to be adopted in the organization, the more unlikely the adoption will occur (Roffia & Mola, 2022). As digital technology is considered a complex IT innovation, SME managers might assume that the adoption of digital technology is somewhat tricky and cannot be implemented within their current business systems (Maroufkhani et al., 2020). Such a perception might arise owing to their need for more knowledge of using ICT-related technology (Awa, Ojiabo et al., 2017). Complexity appeared to be a key driver for digital technology adoption among SMEs in developing countries, such as Iran (Maroufkhani et al., 2020) and Malaysia (Ali et al., 2021). However, Ahmad, Abu Bakar, and Ahmad (2019) contend that young respondents are ostensibly familiar with advanced technology and hence are more confident in their adoption of such technology than older respondents, inferring that the complexity of the technology in question was not an inhibitor for younger respondents to adopt innovative technology.

**Perceived Security.** Perceived security is the extent to which a particular technology is sufficiently secure for use in business activities (Kim, Tao, Shin, & Kim, 2010; Abed, 2020). As the internet enables most digital technology, it is therefore prone to various attacks. Despite some improvements having been made to make the internet safer for users, it remains susceptible. As a result, digital technology poses inherent security threats, including malicious attacks, such as data transactions and financial and personal information attacks (Turban, Outland, King, Lee, Liang, & Turban, 2018).

Perceived security has been identified as SMEs' most critical inhibitor of digital technology adoption. Valmohammadi and Dashti (2016) argued that firms are reluctant to adopt digital technology if the adoption compromises their security, particularly in losing sensitive business information. Meanwhile, Sila (2019) highlighted that small firms are more concerned about digital technology security than larger enterprises. Ghobakhloo et al. (2022) elucidated that the main security threats of digital technologies for SMEs are related to ownership, information, hardware, and vulnerability challenges. Previous studies have demonstrated the negative relationship between perceived security and firms' intention to adopt digital technology (e.g., Ilin et al. 2017; Sanchez-Torres and Juarez-Acosta, 2019; Chau, Deng, Tay, 2020; Maroufkhani et al., 2020). Thus, SMEs will outsource digital technology only if they have generated a certain level of confidence regarding its security.

## 2.2 Organizational context

**Human resources.** Firms' managers are inclined to consider their employees' knowledge of such before adopting specific technologies to ensure that the technology can be effectively applied within the organizations (Valmohammadi & Dashti, 2016). Human resources are due to firms with adequate IT knowledge being able to absorb advanced technologies in a timely fashion and subsequently harnessing the associated technology compared to firms that lack such knowledge (Giotopoulos, Kontolaimou, Korra, & Tsakanikas, 2017). Additionally, Sunday and Vera (2018) asserted that technology adoption has evolved from a more straightforward, one-off event adoption process to a dynamic process that requires substantial human engagement, implying the importance of organizations having human resources capable of operating such technology. As operating digital technology requires specific skills, SMEs often tend to postpone their intention to accept digital technology until their staff's IT knowledge can be improved in this regard (Kurnia et al., 2015). A lack of human resources capable of operating digital technology within the firms is considered the critical hurdle to firms' adoption of new technology (Halaweh and Al Qaisi, 2016; Liébana-Cabanillas & Lara-Rubio, 2017; Yadav & Mahara, 2019).

**Top Management Support.** Grover and Goslar (1993) defined top management support as the degree to which the upper echelons of an organization encourage the uptake of technology innovation for business purposes. Sila (2013) argued that decision-makers positive attitudes toward change could enhance a firm's receptivity to adopting specific technology. Top management often directs the establishment of essential IT infrastructure to facilitate technological adoption. In addition, top management plays a paramount role in enabling technology uptake by mitigating employee resistance that may arise from the adoption (Kurnia et al., 2015). The more supportive the top management's involvement in adopting new technology, the greater the possibility that technology adoption will occur (Swani, 2021). Extant studies have discovered the nexus between top management support and SMEs' decisions to engage with digital technology in their business activities (Deng, Duan, & Luo, 2019; Maroufkhani et al., 2020; Khayer, Talukder, Bao, & Hossain, 2020)

***Firms' Digital Culture.*** Factors Influencing Digital Technologies Adoption 233 assumptions, and values by which a firm conducts its business activities (Ke & Wei, 2008; Zhen, Yousaf, Radulescu, & Yasir, 2021). Organizational culture becomes paramount for the success of projects that require organizational changes. Meanwhile, some scholars expand the term to include a digital context known as digital culture. Digital culture is a set of mutual assumptions and knowledge regarding the digital operation within the organization (Martínez-Caro, Cegarra-Navarro, & Alfonso-Ruiz, 2020). El Sawy et al. (2016) explain that digital culture may include flexible working styles, a digital-first mindset, and data-oriented, which may impact the degree to which the digital process is used in new initiatives. Evidence shows that digital culture has a positive relationship with firms' digitization (Martínez-Caro et al., 2020) and contributes positively to the degree of digitalization in the organization (Proksch et al., 2021).

***International Orientation.*** International orientation is characterized as firms that actively pursue opportunities from the international realm, consider the world as their market, articulates their global objectives across the organizations, and enhance the resources necessary for international activities (Moen, Heggeseth, & Lome, 2016). Firms' top management implements a solid commitment to helping and establishes a culture that can stimulate staff's behavior toward international activities (Birru, Runhaar, Zaalberg, Lans, & Mulder, 2019). It is often achieved through aligning the organizations' structure, system, and resources with technology and leveraging technology as the main competency (Masa'deh, Al-Henzab, Tarhini, & Obeidat, 2018). Firms with high international orientation often take necessary actions to engage with new technological innovation to make their products meet the requirements of global markets (Brouthers, Nakos, & Dimitratos, 2015). In contrast, firms with lower international orientation are less innovative and thus less willing to make radical changes to accommodate the needs of new technology in their business activities. Ferreira et al. (2022) assert that going digital endows firms with higher competitiveness, allowing them to expand to a new market. Building from this perspective, firms' international orientation can be used as a predictor of SMEs digital technology adoption as some evidence suggest that digital technologies aid firms in achieving global market (Hervé, Schmitt, & Baldegger, 2020; Eze, Chinedu-Eze, Awa, & Alharthi, 2021).

### 2.3 Environmental Context

***Government Support (resource and regulatory).*** Unlike large enterprises that can seemingly adopt new technology without their government's assistance, SMEs, especially in developing countries, require further government assistance to engage with new technology (Mkansi, 2021). Government support refers to government policies and efforts to foster technology adoption (Chau et al., 2020). However, since government support for increased digital technology adoption is extensive and diverse, Ilin et al.(2017) proposed two categories to classify it: (1) governmental policies related to resource support and (2) governmental policies related to regulatory support.

The former, including the availability of IT infrastructure, funding mechanisms, and training facilities for SMEs to adopt new technology, is a determinant of technology adoption among SMEs (Sila, 2019; Maroufkhani et al., 2020). Meanwhile,

the latter related to regulatory support encompasses the regulations that allow for a positive economic climate (e.g., data protection) and has been argued to represent a driving factor behind SME e-digital technology adoption (Park & Kim, 2021; Ocloo et al., 2020). However, it must be understood that not all government support would be beneficial for improving digital technology adoption. For instance, the suitability of government support (Mohtaramzadeh et al., 2018) or the government's funding (Maroufkhani et al., 2020) might impact SMEs' perception of the support.

**Trading Partner Pressure.** Trading partner pressure in technology adoption refers to a mandate given by trading partners to their distributors to engage with particular technologies (Dwivedi et al., 2018). As the benefits they can realize from the technology adoption are higher only if most of their trading partners within their distribution chain have engaged with such technology, trading partners often request that their distributors engage with a particular technology to obtain a competitive advantage (Chang, 2020). For instance, communication between parties within the distribution chain can be enhanced if all the parties have engaged with the same technology (Abed, 2020). Furthermore, small firms have been considered less influenced within the industry ecosystem. They are often required to adhere to the requirements made by their trading partners, albeit they need to realize the benefits that new technology entails (Kurnia et al., 2015). Some studies have found a relationship between trading partner pressure and a firm's digital technology adoption (e.g., Guo and Bouwman, 2016; Deng et al., 2019).

**Competitive Pressure.** Zhu, Kraemer, and Xu (2006) refer to competitive pressure as the degree of pressure that firms discover due to the competition in the market. Hence, firms often respond to the competition by adopting certain technologies to be competitive in the industry (Ahmad et al., 2019). One of the reasons SME managers tend to follow their competitors in their adoption of technology is that they fear market displacement when their competitors have already engaged with a particular technology. Additionally, they want to avoid being regarded as lagging, particularly from their customers' perspectives. Fear of market displacement has encouraged SMEs to adopt technology when their competitors have already done so (Abed, 2020). Competitive pressure has been identified as a critical factor in the adoption of digital technologies in various studies (Mohtaramzadeh et al., 2018; Wong et al., 2020, Abed, 2020).

### 3 A conceptual framework

After reviewing the literature presented in section 4 above, this paper proposes a conceptual framework as depicted in Figure 1 below. The conceptual framework consists of the TOE framework and Roger's (2003) DOI that can be used to investigate factors that affect digital technology adoption among SMEs in Indonesia. There are thirteen variables: adoption costs, perceived benefits, compatibility, complexity, perceived security, top management support, human resources, digital culture, international orientation, government regulatory support, government resource support, trading partner pressure, and competitive pressure.



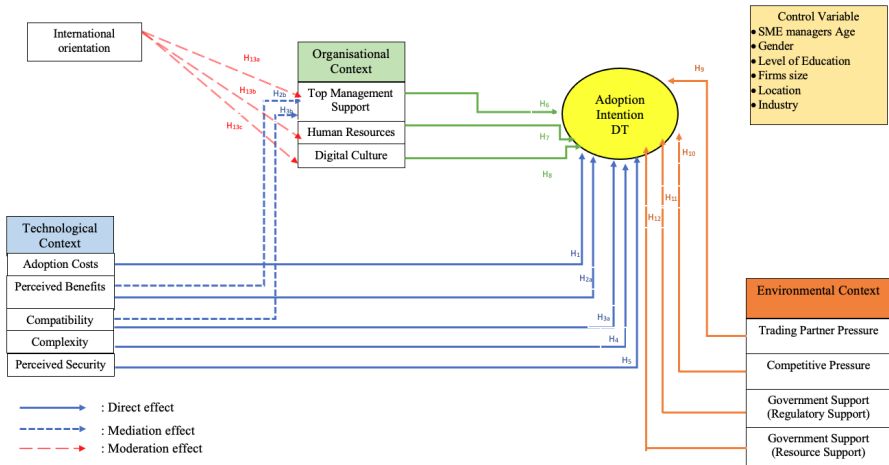


Fig. 1. Conceptual Framework.

## 4 Conclusion

The conceptual framework, as shown in Figure 1 above, enables researchers to examine and comprehend the drivers behind digital technology adoption in the context of SMEs. The results may provide information for stakeholders who aim to improve SMEs' digital technology adoption in Indonesia. For instance, policymakers will obtain excellent knowledge about the barriers, problems, and factors influencing or affecting the adoption of digital technologies among SMEs and can reformulate the policies to improve the adoption. The results of this study may improve SME managers' understanding of essential factors affecting digital technology adoption, thereby assisting them in evaluating the condition and potential drivers that would lead to the successful adoption of digital technologies.

Furthermore, as some scholars have concluded that there is a general lack of research about the moderating roles in the IT adoption field (e.g., Oliveira et al., 2019; Alsaad et al., 2019; Salah et al., 2021), this research attempts to fill the gap by presenting the moderating effect of international orientation on the influence of organizational factors and digital technology adoption. Oliveira et al. (2019) argued that examining the moderating effects will have a more profound impact on the growing knowledge in the IT adoption field rather than purely looking at the direct effects between independent and dependent variables.

The main limitation of this study is that it is still collecting data; hence, it could not offer any empirical results. However, the development is currently taking place. Another limitation is that this study uses a cross-sectional survey. Thus, it only reflects the participants' perception at a particular time. Meanwhile, participants' perceptions may change over time, and a longitudinal survey might be warranted to overcome this issue. Furthermore, this study generally engages with SMEs in Indonesia without specifying the industries. As Ferreira et al. (2022) explain, the factors that affect digital technology adoption can be different across the SME sector. Therefore, future studies may consider analyzing factors affecting digital technologies

among SMEs based on a specific industry (e.g., manufacturing, service, or agriculture) for creating a conceptual framework.

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