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Driving Digital Transformation: How Transformational Leadership Bridges Learning Agility and Digital Technology Adoption in MSMEs

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Abstract

Objectives: The utilization of technology within an organization is believed to enhance its effectiveness and efficiency. To reap the benefits of technology, MSMEs must adopt digital technology innovation. Individuals and its capabilities within the organization play a significant role in digital technology innovation adoption. This study aims to examine the nexus between learning agility, transformational leadership, and adoption to digital technology innovations. *Methods:* This study examines the hypotheses involving 203 employees of MSMEs utilizing PLS-SEM. *Results:* PLS-SEM results show that learning agility and transformational leadership affect digital technology innovation adoption. Accordingly, transformational leadership mediates the connection between learning agility and the adoption of digital technology innovations. *Novelty:* This research has implications for organizations in adopting digital innovation, where organizations can optimize individual learning agility and utilize transformational leadership styles to persuade employees to adopt digital technology innovation. Furthermore, this research lies in its comprehensive examination of how transformational leadership can amplify the effects of individual learning agility, thereby fostering a more conducive environment for digital innovation within MSMEs. In addition to a comprehensive discussion, this study provides both theoretical and practical guidelines and provides a thorough examination of both aspects.

Keywords:

Learning Agility;
Transformational Leadership;
Adoption to Digital Technology Innovation;
Micro, Small and Medium Enterprises.

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1- Introduction

The widespread impact of digital technology in today's interconnected global environment is fundamentally transforming corporate operations, causing disruptions in industries, and changing old models of commerce [1]. The pervasive wave of digitalization is having a profound impact on organizations of all sizes, ranging from large multinational firms [2] to micro, small, and medium businesses [3]. Micro, small, and medium companies (MSMEs) play a crucial role in driving economic growth [4] and fostering innovation [5] on a global scale. It is essential to comprehend the reaction tactics and underlying causes that shape the adaptation processes of organizations as they deal with the demands of digital transformation. This understanding is critical for effectively navigating the challenges and opportunities brought about by the digital age.

A considerable proportion of micro, small, and medium firms (MSMEs) in numerous emerging nations have not yet incorporated digital technologies into their operations, despite the increasing number of technologically proficient clients. This disparity highlights a crucial obstacle, while customers are increasingly dependent on digital solutions, many MSMEs are still reluctant to embrace technology-driven advances [6, 7]. MSMEs, in contrast to larger businesses, frequently have limitations in resources that hinder their capacity to adopt digital innovations, hence restricting their

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competitiveness in the market. For MSMEs in developing nations, the use of technology is extremely important in order to achieve sustainable growth and gain a competitive edge in today's ever-changing economic landscape [8–10]. The ability to quickly adjust to technological advancements is key, as is the vital role of leadership in promoting a culture of innovation and providing people with the required skills to succeed in an ever-evolving digital environment [11, 12]. Through the utilization of digital tools and platforms, micro, small, and medium enterprises (MSMEs) can optimize their operational efficiency, expand their market reach, streamline their operations, and enhance customer experiences [13–16]. Hence, it is crucial for MSMEs in developing nations to cultivate a culture of technological innovation and provide their staff with the essential skills in order to prosper in an ever-evolving digital environment.

Learning agility is one of the most important foundations for human resource adaptability in the digital era [17]. Multiple studies have demonstrated that the capacity for learning agility greatly influences an individual's aptitude to adjust and thrive in a novel and ever-changing digital setting [18-20]. Learning agility is known as a component of human resource competency that is frequently underutilized in terms of digital transformation [21], notably for MSME. Prior research has indicated that MSMEs frequently encounter difficulties in embracing digital technologies due to their restricted resources and lack of expertise [22, 23]. Consequently, the ability to quickly acquire new knowledge and skills, known as learning agility, becomes essential for their continued existence and expansion in the digital age. Organizations must determine how learning agility can foster a culture of digitalization. Al-Nuaimi et al. (2022) [24] connected the concept of learning agility, viewed through the lens of the New Institutional Theory, to effectively address the challenges of digital transformation, which is further enhanced by a digital strategy. Moreover, agility is also seen as having the ability to effectively navigate and achieve success in the era of digital change [25]. Learning agility is frequently linked to the broader concept of organizational agility. Organizational agility, on the other hand, refers to a company's ability to create new value through the modification of organizational strategy and resources [26]. This concept is substantiated by multiple studies that emphasize the significance of agility strategy in attaining a competitive edge [27–29]. Meanwhile, learning agility is the aptitude to modify one's thoughts and behaviors and adapt to a new environment when presented with an unfamiliar environment [30]. Studies in this domain indicate that persons who possess a high level of learning agility are more equipped to effectively navigate and flourish in unpredictable and swiftly evolving circumstances [25]. Not only in organizational agility, learning agility is also closely related to the concept of dynamic capabilities, where learning agility in the concept of dynamic capabilities will develop individual potential to be able to adapt to uncertain changes [31], especially in the digitalization era. It emphasizes the types of learning associated with new behaviors or attitudes, such as the competencies and capabilities to learn from experience and perform successfully, as well as the development of digital technologies. Since the digital technology era is continually evolving and diverse, people must be adaptive in their learning.

The use of technology inside an organization is thought to increase its effectiveness and efficiency [32]. The business and operational environment are rapidly changing as a result of modern digital transformation technologies. With the integration of the internet, blockchain, big data, artificial intelligence (AI), and associated technologies, as well as changing client demand dynamics, altering corporate operations has become a key concern [3]. Research has demonstrated that the utilization of digital technology can greatly enhance organizational performance through streamlining processes and enhancing decision-making [33-36]. Therefore, the implementation of digital technology has been linked to gaining a competitive edge and enhancing market responsiveness. Furthermore, this technology's applications span from marketing to operations [37], manufacturing [38], and recruiting [39]. Therefore, organizations must adopt digital technology before they can employ it in their operations. Digital technology innovation adoption is the process of recognizing and integrating new technologies into the usage of pre-existing technology [40]. This approach has been demonstrated to be crucial for organizational innovation and the ability to sustain success over a long period of time [41]. In terms of digital innovation adoption, this is linked to developments in the digitalization age, in which enterprises are challenged to participate [42]. In consequence, the roles of leaders and subordinates as stakeholders in an organization in adopting digital technology are crucial. Accordingly, the role of leadership was discovered to be a key aspect in motivating people to participate in new digital technology procedures and practices [43]. The role of leaders in facilitating and supporting the transition to the digital era has been extensively discussed in the literature [44-47]. Leaders may help organizations to be successful in the digital era by applying strategic leadership in digital transformation [26], staying ahead of new technological developments, defining digital change paths and investment plans, and leading teams through rapid and precise change [48].

Nevertheless, many organizations are unsuccessful in achieving digital transformation because they begin with technical change without developing individual capability in embracing technology [49]. Research emphasizes the significance of developing a digital mindset among employees to achieve successful transformation [50]. Within businesses, leaders must assure the development of the digital mentality and agility required to adapt to the disruptions associated with digital technology adoption [51]. In the context of the present study, transformational leadership is discovered to affect subordinates' participation in the process of change and adoption of digital technologies [52]. However, it is very challenging for a leader to arrange all the information, and abilities needed by technological progress. Consequently, in this digital era, we expect that a leader's responsibility in embracing digital technology cannot be fulfilled without the participation of his subordinates. This demonstrates a gap in the academic literature when it comes

to the nexus among employees' learning agility, transformational leadership, and digital technology adoption in the context of MSMEs. Fragmented research shows that employee adaptability and leadership in digital transformation may be equally significant to employees' capacity to accept digital transformation in MSME firms.

The objective of this study is to analyze the influence of learning agility and transformational leadership on the adoption of digital technology in micro, small, and medium enterprises (MSMEs) in Indonesia. Moreover, this study seeks to enhance the existing comprehension of the factors that impact businesses' responses to digital transformation by expanding and intensifying the analysis. In an organization, we contend that both subordinates and leaders bear the responsibility for cultivating learning agility. Learning agility is the ability of people to adapt their thinking, acquire new knowledge, and create innovative solutions for present and future difficulties. Secondly, learning agility refers to the ability of leaders to create a favorable environment for the organization to embrace digital technology advancements. Prior studies have exclusively examined the adoption of technology in organizations, neglecting the role of transformational leadership in this process [25, 53-55]. To the best of our knowledge, no previous research has focused on the learning agility of employees in adapting to digital technological innovation involving the transformational leadership concept.

Eventually, our research provides three important contributions. This research expands our empirical understanding of the factors influencing digital technology innovation adoption in MSMEs by highlighting the impact of employee learning agility on digital technology innovation adoption. Second, this research investigates the interrelationship between learning agility, transformational leadership, and MSMEs adoption of digital technology innovation. Despite the intuitive appeal of the theoretical argument for the contribution of learning agility and transformational leadership to the adoption of digital technology innovation by digital MSMEs, there is no research on this topic. In addition to addressing these concerns, our research investigates whether transformative leadership mediates this process. Third, our research on the adoption of digital technology by MSMEs in an efficiency-driven economy has practical implications for practitioners and policymakers in all nations seeking to develop digital technology-driven competitiveness.

2- Literature Review and Hypotheses Development

2-1- Micro, Small, and Medium Enterprises (MSMEs)

MSMEs, which stands for Micro, Small, and Medium-Sized Enterprises, can have different meanings and importance depending on the country and research findings [56]. The variety in the MSME sector arises from its various natures, which frequently offer chances to individuals who may lack access to larger organizations [57]. MSMEs have become essential catalysts for economic progress in recent years, playing a major role in facilitating financial expansion and advancing economic parity, especially in the era of digitalization.

Prior studies have identified many obstacles that micro, small, and medium enterprises (MSMEs) face when undergoing digital transformation [58]. Their capacity to effectively utilize digital tools and platforms can be impeded by limited resources, such as financial limitations and a lack of technological proficiency. Moreover, micro, small, and medium enterprises (MSMEs) frequently encounter challenges when it comes to adjusting their organizational frameworks and procedures to synchronize with digital strategies [59]. These issues are worsened by variables such as legislative hurdles and insufficient access to digital infrastructure [60]. Nevertheless, micro, small, and medium enterprises (MSMEs) have intrinsic benefits, like adaptability and close proximity to nearby marketplaces, that can be utilized to take advantage of growing digital prospects [61].

Gaining insight into the intricacies of Micro, Small, and Medium Enterprises (MSMEs) in the era of digitalization is crucial for individuals and organizations aiming to facilitate their expansion and long-term viability. Through the examination of the convergence of digital technologies and MSMEs, MSMEs can discover approaches to improve their competitiveness [62], stimulate innovation [63], and facilitate inclusive financial improvement [64].

2-2- Dynamic Capability Theory

In this research, we employ the dynamic capability (DC) theory, which is described as an internal competency that exists within an organization [65] and refers to the process of identifying, creating opportunities, and transforming [66]. DC is also defined as an individual's capacity to innovate, adapt, and outperform competitors [67] and it is also applied in uncertain circumstances [68]. Those processes utilize current resources to adapt to their surroundings. Therefore, it is essential for businesses to restructure their knowledge and capabilities in order to increase the high levels of resources, and the new circumstances are fraught with uncertainty [69, 70]. In order to compete and maintain a sustainable competitive advantage, businesses must adapt to change periodically.

Human aspects of an organization's response to change occupy a prominent position in the literature on contemporary organizational change. More specifically, employee resistance to change is one of the most important factors for companies [71] in terms of competing and maintaining a sustainable competitive advantage. DC is necessary for the adaptability of employees within organizations in both internal and external environments [72]. Thus, DC must be significantly strengthened in order for organizations to adapt to dynamic changes.

In addition, the theory of DC is associated with the capacity of organizations to rebuild internal and external capabilities in response to fast environmental change [73], which is also experienced by MSME in Indonesia, necessitating the ability to adapt to digital technology innovation [74]. In this instance, learning agility among organizational personnel is supported by the theory of DC, in which human resource capabilities are developed based on organizational needs, particularly humans, as their resources to adapt to changes in the digital age [17].

2-3- Prior Study and Identification of the Gap

In order to accelerate the adoption of digital technology innovations, a thorough literature review was implemented. In general, there has been a significant amount of research conducted on the adoption of digital technologies; however, the majority of these studies involve large corporations. Factors that motivate the adoption of digital technologies have been identified in prior research. For instance, Bunjak et al. (2022) [17] determined that transformational leadership, in the form of shared leadership, can encourage the integration of technology into the work environment of multinational corporations in developed countries, such as Germany. The findings indicate that the adoption of digital technologies is influenced by both transformational and shared leadership, with shared leadership serving as a mediator between the two. Nevertheless, these results still provide opportunities for further investigation in the context of industry scope. Therefore, this investigation endeavors to assess the situation from the viewpoint of micro, small, and medium-sized enterprises (MSMEs) in developing nations.

Additionally, the study conducted by Thoumrungroje & Racela (2021) [75] assessed the correlation between the adoption of digital technologies and agility. The findings demonstrate that agility can lead to the adoption of digital technologies, thereby enhancing the performance of organizations. Nevertheless, this study does not incorporate leadership factors to promote the adoption of digital technology. Consequently, there is still room for further exploration by investigating the effectiveness of leadership and agility factors in promoting the adoption of digital technology. In the context of digital transformation in manufacturing enterprises in eastern Europe, Hargitai & Benscik (2023) [76] also advocates for digital learning and the role of leadership. However, the study offers the supportive leadership style approach for promoting digital learning in the era of digital transformation. Consequently, the discussion space remains expansive in order to ascertain leadership concepts that are most suitable for the strategic approach in the digital transformation era. In addition, we were unable to locate any research that employed the concepts of dynamic capability and leadership to simultaneously drive the adoption of digital technology in MSMEs, particularly in developing countries like Indonesia. This lacuna that has not been evaluated will facilitate ongoing research. Table 1 provides a concise overview of prior research that pertains to the theory and applied context.

Table 1. Prior Study and Identification of the Gap

Author(s)	Dynamic Capabilities Approach	Transformational Leadership Concept	Digital Technology Innovation Adoption	MSMEs in Developing Country	Findings
Bunjak et al. (2022) [17]	Yes	Yes	Yes	No	The study findings revealed that shared leadership mediated the relationship between perceived transformational leadership and followers' IT innovation adoption at the individual level. Moreover, organizational-level management innovation moderated the relationship between transformational leadership and IT innovation adoption, mediated by shared leadership.
Thoumrungroje & Racela (2021) [75]	Yes	No	Yes	Yes	Results reveal that new technology adoption is driven by higher-level competencies such as international marketing agility, which develops, integrates and reconfigures resources through the three first-order capabilities to enable SME exporters to cope with volatile environments. Such adoption is enhanced by SME exporter perceptions of internet-enabled inventory management system's relative advantage, but is otherwise diminished by perceptions of its complexity.
Hargitai & Benscik (2023) [76]	Yes	No	Yes	No	Leadership behavior and a supportive management style inspire the development and training of employees, through which the level of readiness for digitalization and Industry 4.0 technologies can be increased. Training in these skills will increase confidence in digitalization technologies. Leadership support also influences digital trust and employee response to the use of digital technologies, as does participation in training, which directly supports digitalization and I4.0 readiness.
This Study	Yes	Yes	Yes	Yes	Results show that learning agility and transformational leadership affects digital technology innovation adoption. Accordingly, transformational leadership mediates the connection between learning agility and the adoption of digital technology innovations. This research has implications for organizations in adopting digital innovation, where organizations can optimize individual learning agility and utilize transformational leadership styles to persuade employees to adopt digital technology innovation.

2-4- Learning Agility and Adoption to Digital Technology Innovation

MSMEs are often referred as the economic engine of a nation, particularly in developing nations such as Indonesia. In a world driven by the advancement of information and technology, the success and survival of MSMEs rely on their capacity to interact with and adapt to new technical advances [6, 77]. This capability is sometimes referred to as learning agility, which is viewed as a strategic and intangible resource that connects the capacity for adaptation and acceptance of organizational change. This capability is acknowledged by the DC approach.

Learning agility is defined as an individual who is willing to learn from experience when presented with a novel circumstance, enabling them to adapt their actions and attitudes appropriately [21]. Learning agility and the concept of DC are closely associated. The concept of agility, which is defined as an organization that can flexibly and quickly respond to change [78], emerged in the management sciences in recent decades [79-83]. This concept evokes a perspective on organizational agility as a whole. This perspective is related to the process of value creation and the strategic resource transfer that it necessitates [80, 82]. However, the literature on agility in an organization in several researches, mostly focuses on an external process [37, 38, 79, 81] without delving further into the internal underlying processes.

Adoption of digital technology innovation, which Moore & Benbasat (1991) [40] determined as the diffusion of technology within organizations, was one of the earlier information system researchers [84]. It is arduous to convince employees to use new technology at the workplace. People are used to avoiding change, even when it's for their own good and this may also occur when an organization implements new technology. Therefore, the complexity of applying technology to digital technology innovation is inextricably linked. Thus, when changes occur, especially in adopting digital technology innovation, individual perceptions about the use of digital technology innovation will influence their decision about whether they will use it or not [85]. To implement successful digital technology innovation adoption in the workplace, the involvement of all stakeholders and considerable organizational resources are required [86].

Thoumrungroje & Racela (2021) [75] examined the association between agility and the adoption of new technologies on the performance of MSMEs in developing nations using data from Thailand. This research investigates the effect of marketing agility on the adoption relationship of new technology, taking into account the relative benefit and complexity of the new technology. This research demonstrates a positive correlation between the success of Thailand's MSMEs and the factors outlined in this study. These results present a significant incentive for MSME stakeholders to utilize technology in order to enhance their organizational performance in growing markets. This demonstrates that agility brings organizations to a higher level of performance by adopting digital innovation in MSMEs. This refers to organizational human capital, whereby knowing human capital agility is a guide to understanding organizational agility as a whole.

H1*: Learning agility of employees is positively related to the adoption of digital technology innovation*

2-5- Transformational Leadership and Adoption to Digital Technology Innovation

Leaders are seen to have a crucial impact on their followers' use of technology in the workplace [87]. According to our research, innovation is an essential component of technological advancement. Similarly, the adoption of digital innovation entails a complicated process and has a close relationship with how humans perceive technology [88], which influences their choice to accept it or not.

Leadership is seen as one of the most important parts of an organization's values and beliefs. As an organization changes over time, so must its leadership [89]. Organizations make the switch to digital transformation by making real changes to how they run and deliver their products and services [17, 90]. Organizations conduct this by fostering digital cultures that thrive [91]. It wouldn't be possible without leaders who set up places for it to happen and push other people to act [17].

Literature has underlined the significance of a leader in ensuring and driving the transition to Industry 4.0 [47]. Leaders play a crucial role in the success of businesses in the digital era through three habits: (1) being abreast of new technological trends; (2) determining the path of digital transformation and investment plans; and (3) guiding the team to change rapidly and accurately [92]. Particular emphasis has been placed on transformational leadership in the digital transformation literature that analyzes leadership in digital contexts [17, 93]. Transformational leaders inspire confidence, aim to cultivate leadership in others, demonstrate self-sacrifice, and act as moral agents, concentrating themselves and their followers on objectives that transcend the immediate demands of the work group [45].

Transformational leadership reflects a significant driving factor behind the adoption of digital technology innovation in the workplace [17]. Bunjak et al. (2022) [17] mentioned that important features like ease of use or usability aren't enough for people to accept new technology, they also need a clear leadership vision on how to use technology in order to use and embrace it [17]. In accordance with the four sub-dimensions of transformational leadership, including

individual consideration, intellectual stimulation, inspirational motivation, and idealized influence [94], research demonstrates that transformational leadership influences the behavior of its followers in responding to changes in digitalization [93]. Transformational leadership can simplify the complexity of digital innovation through support and motivation when digital technology innovation becomes difficult to implement [17]. Particularly, transformational leadership can encourage followers to issue creative ideas [95] and stimulate the thinking of followers to be able to think critically when doing work in order to generate new business ideas [96]. Therefore, transformational leadership assumes an important role in order for followers within an organization to present innovative solutions to technological change [97] and influence perceptions of technology use within organizations [98].

***H2**: Transformational leadership is positively related to the adoption of digital technology innovation*

2-6- The Mediating Relationship

As a mediator between learning agility and digital technology innovation adoption, leader plays an important role. Transformational leadership has been shown to influence knowledge sharing among people [99], which can facilitate the process of adopting digital technology innovations in individuals [17]. Likewise, transformational leadership has been associated with workplace success in transforming to digital technology [93], which may be positively related to leaders' information literacy and innovative processes within organizations [100]. Phillip (2021) [93] demonstrates that the participation of leaders in adopting the new technology is crucial because, during the transformation processes, the link between leaders and subordinates is essential for effective communication and will ultimately encourage the implementation of innovative ideas within the organization. Thus, it highlights the significance of leader participation in the workplace adoption of new technology [45, 101, 102].

Individuals with a desire to learn from experience will be able to respond swiftly and flexibly to change and modify their behaviors and attitudes accordingly if they possess learning agility [103]. Several studies have been conducted to analyze the association between learning agility and digital technology innovation adoption processes [17, 21, 75], and during those processes, the participation of the leaders is required in order to advocate, evoke, and motivate the subordinates to come up with innovation and create change that will contribute to the organization's growth and future success [104]. The core concept of leadership is influencing followers. Commonly, leaders influence followers by assigning objectives and tasks and giving feedback that results in rewards or punishment, which is crucial in deciding the motivation of followers to work well in the workplace [105]. Yukl (1998) [106] defines transformational leadership as leadership behavior through a leader's approach influencing the behavior of followers, so that the values shared by leaders and followers can be aligned in doing work for the organization beyond their personal interests. Therefore, we assume that transformational leadership can facilitate the development of a sense of community among followers, leading to better learning agility in digital technology innovation adoption.

***H3**: Transformational leadership is positively mediating the nexus between learning agility and the adoption of digital technology innovation*

Figure 1 shows the flowchart of the research framework through which the objectives of this study were achieved.

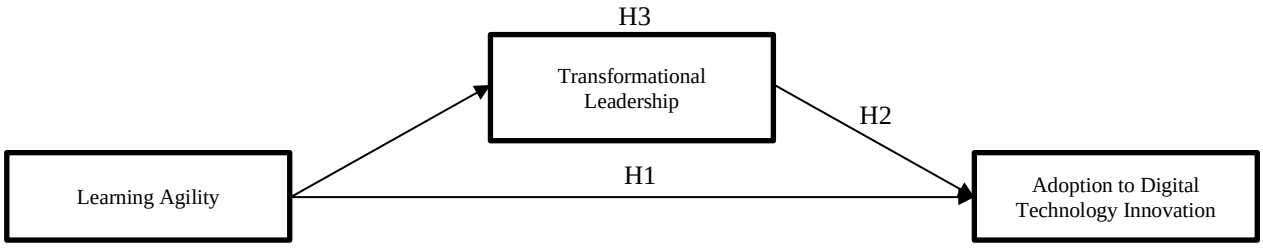

Figure 1. Research Framework

3- Research Methodology

3-1- Research Design

The research was conducted in a series of phases, commencing with a comprehensive description of the research methodology, which encompassed a research design, quantitative approach, and sampling methodologies. The subsequent phase involves the collection, analysis, and testing of hypotheses, the formulation of findings and discussions, and the presentation of recommendations. A more comprehensive flowchart of the research stages is provided in Gigure 2.

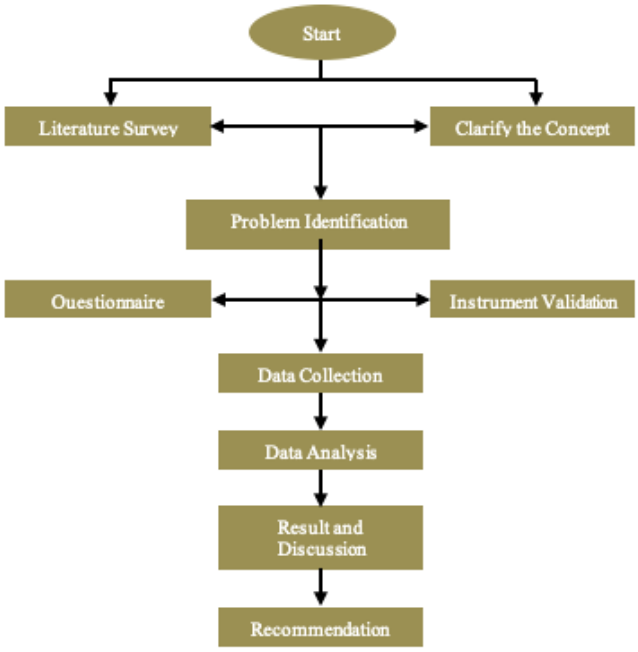

Figure 2. Research Design

3-2- Measurement Instrument

This study is based on a survey encompassing learning agility, transformational leadership, and the MSME's adoption of digital technology innovation. The survey consists of three parts. The first part gathers information about human capital, with learning agility as its component, while the measurements were adopted from Bedford (2011) [107]. In the second part, we assess four dimensions of transformational leadership behavior through the instrument adopted from Bass & Avolio (1994) [94] while the third part measures micro, small and medium businesses' adoption to digital technology innovation were adopted form Moore & Benbasat (1991) [40]**.** The target population was micro, small and medium businesses in Indonesia operating in all industries. Thus, the total number of measurement items used to measure all variables are 39 items. Furthermore, the data collection instrument used in this study was a questionnaire instrument, using a 5-Likert scale representing strongly disagree and strongly agree, shows on Table 2. The questionnaire instrument developed is then distributed to the questionnaire using an online survey approach. A Pilot study was conducted in this research before the questionnaires were delivered to the intended population. This pilot study questionnaire was initially evaluated on 50 MSMEs employees who volunteered to take part. Cronbach's alpha reliability was examined through this pilot study and preliminary test. A Cronbach alpha value greater than 0.80 is required to demonstrate an acceptable level of reliability in a pilot test. The stages held in this research consist of: first, measurement model analysis with construct validity and the discriminant validity method. Second, hypothesis testing. Next, the result is discussed in detail in this research.

Table 2. Construct and Measurement

Construct	Number of Items	Type of Scale	Sources
Learning Agility	9 items	5-Point Likert-Type Scale	[107]
Transformational Leadership	16 items	5-Point Likert-Type Scale	[94, 108]
Adoption to Digital Technology Innovation	14 items	5-Point Likert-Type Scale	[40]

3-3- Data Collection and Sample

This research data originates from micro, small, and medium-sized businesses in Indonesia. Purposive sampling was determined as part of data collection in this study because, while collecting this data, the researcher first sought the respondents' agreement to fill out the questionnaire, and the respondents completed the questionnaire. In this study, the researchers opted to disseminate the questionnaire online to make it simpler to gather replies while completing the questionnaires. Companies are contacted directly through email, LinkedIn, and WhatsApp using data from the database of micro, small, and medium-sized enterprises using a Google Form. The survey link is accessible between November 2022 and December 2023. This document provides information on learning agility as the capacity of an employee to adopt digital technology innovation and the role of transformational leadership within it. The target population of this study comprises employees from Indonesia's MSME sector, where their companies have implemented digital technology in their business operations. The survey was completed by 203 participants in accordance with the recommended threshold. According to the collected data, 28.57% of respondents were employed by micro-enterprises, 28.08% were employed by small enterprises, and the remaining 43.35% were employed by medium enterprises. The survey shows that 32.02% of businesses were established before 2005, 6.40% were established between 2005 - 2010, 20.69% were established between 2011 - 2016, and the remaining 40.89% were established between 2017 - 2022. The sector of the

industry includes manufacturing (10.34%) trade (29.56%) and services (60.10%) and when it comes to the amount of experience that employees in this sector have, the numbers show that 24.63% of workers have less than 2 years of experience, 25.62% have between 2 and 5 years of experience, and the remaining 49.75% have more than 5 years of experience. Comprehensive demographic information is provided in Table 3, which also includes the industry profile of the sampled respondents.

Table 3. Characteristics of respondents (n=203)

Demographic Characteristics		Frequencies	%
Type of enterprise	Micro enterprise	58	28.57
	Small enterprise	57	28.08
	Medium enterprise	88	43.35
Year of establishment	Before 2005	65	32.02
	2005 – 2010	13	6.40
	2011 – 2016	42	20.69
	2017 - 2022	83	40.89
Type of industry	Manufacturing	21	10.34
	Trading	60	29.56
	Services	122	60.10
Year of association	Below 2 years	50	24.63
	2 – 5 years	52	25.62
	Above 5 years	101	49.75
Number of employees	Less than 10 employees	70	34.48
	10 – 30 employees	51	25.12
	31 – 300 employees	82	40.39
Gender	Male	112	55.17
	Female	91	44.83
Age of participants	Below 30	64	31.53
	30 – 50	135	66.50
	Above 50	4	1.97
Latest education	High School	15	7.39
	Associate Degree	12	5.91
	Bachelor Degree	136	67.00
	Master Degree	40	19.70
	Doctoral Degree	0	0

3-4- Data Analysis

In this study, Smart PLS 3.0 software was utilized to analyze data, test hypotheses, and evaluate the validity and reliability of the questionnaire. Type of enterprise, year of establishment, type of industry, year of association, and other descriptors of respondents are included. PLS-SEM is utilized to search for latent patterns in data and to learn more about the relationships among variables. Confirmatory factor analysis is used to test the validity and reliability of constructs and the measurement scale is developed using these three criteria. First, the composite reliability of latent variables (CR) must be greater than or equal to 0.70 [109]. Then, the average variance extract (AVE) with a value of 0.5 is utilized to determine the convergence validity value [109]. Eventually, confirmatory factor analysis was used to determine a factor loading of 0.7 [110].

4- Results

4-1- Measurement Model

Construct validity is used to analyze the reliability and validity of study findings. Hair et al. (2017) [110] investigated construct validity by comparing each construct item's factor loading value to 0.7. Construct validity is indicated by the fact that each factor loading value is greater than 0.7, with values ranging from 0.738 to 0.955. The AVE value was then compared to 0.5 for a convergent validity test. In this study, the AVE value was greater than 0.5, ranging between 0.587 and 0.859 in value. Furthermore, Cronbach's alpha and composite reliability scores were used to assess the internal consistency of the study concept. Cronbach's alpha and composite reliability values are regarded as fulfilled if greater than 0.7, as Hair et al. (2017) [110] indicate. Both values were reached in the investigation, hence the construct is internally consistent and in a good position, with values ranging between 0.876 and 0.969 for Cronbach Alpha, while 0.912 and 0.973 for composite reliability. In general, the convergent validity value is greater than the threshold, indicating that the convergent validity of this study is adequate. The findings of concept validity, convergence, and internal consistency are shown in Table 4.

Table 4. Construct Validity and Internal Consistency

First-Order Constructs	Second-Order Construct	Items	Factor Loading	AVE	CR	Cronbach's Alpha
Learning Agility						
		LA1	0.794			
		LA2	0.738			
		LA5	0.803	0.587	0.927	0.912
		LA6	0.827			
		LA7	0.845			
		LA8	0.784			
		LA9	0.765			
	Transformational Leadership			0.818	0.947	0.926
Idealized Influence						
		II1	0.851			
		II2	0.898	0.767	0.929	0.899
		II3	0.870			
		II4	0.882			
Inspirational Motivational						
		IM1	0.916			
		IM2	0.892	0.766	0.929	0.899
		IM3	0.809			
		IM4	0.880			
Intellectual Stimulation						
		IS1	0.851			
		IS2	0.902	0.769	0.930	0.900
		IS3	0.869			
		IS4	0.886			
Individual Consideration						
		IC1	0.866			
		IC2	0.947	0.859	0.960	0.945
		IC3	0.955			
		IC4	0.936			
	Adoption to Digital Technology Innovation			0.818	0.947	0.926
Compatible						
		C1	0.889	0.801	0.924	0.876
		C2	0.923			
		C3	0.873			
Relative Advantage						
		RA1	0.884			
		RA2	0.915			
		RA3	0.897			
		RA4	0.929	0.821	0.973	0.969
		RA5	0.904			
		RA6	0.941			
		RA7	0.874			
		RA8	0.901			
Perceived Ease of Use						
		PEU1	0.827			
		PEU2	0.922	0.755	0.912	0.969
		PEU3	0.889			

Note: LA, Learning Agility; II, Idealized Influence; IM, Inspirational Motivational; IS, Intellectual Stimulation; IC, Individual Consideration; C, Compatible; RA, Relative Advantage; PEU, Perceived Ease of Use.

After convergent validity was established, this study examined for discriminant validity. In order to evaluate the Fornell-Larcker criterion, we first compared the square root of the AVE to the correlation between all constructs. Based on the results of the discriminant validity test, the square root AVE value was greater than the correlation between constructs, which ranged from 0.305 to 0.449. According to the Fornell-Larcker criterion [109], the discriminant validity of these findings is adequate. The heterotrait-monotrait ratio (HTMT) is a new criterion for evaluating discriminant validity with a strict threshold of 0.85, as suggested by Henseler et al. (2015) [111]. According to the findings of the study, the range of HTMT values is between 0.319 and 0.474, which is less than the acceptable threshold of 0.85. Thus, the measurement model evaluation phase of this research was effectively concluded, and the structural modeling analysis phase commenced. Tables 5 and 6 present the discriminant validity results.

Table 5. Discriminant Validity Fornell-Larcker Criterion

	ADTI	LA	TL
Adoption to Digital Technology Innovation	**0.833**		
Learning Agility	0.449	**0.774**	
Transformational Leadership	0.305	0.307	**0.805**

Note: The bolded and green highlighted numbers indicate the AVE square root value and the remaining are the inter-construct

Table 6. Discriminant Validity Heteroit-Monotrait Ratio

	ADTI	LA	TL
Adoption to Digital Technology Innovation	-	-	-
Learning Agility	0.474	-	-
Transformational Leadership	0.319	0.323	-

Note: HTMT is less than suggested threshold, 0.85 [46].

4-2- Structural Model Assessment

Based on the hypothesized relationship in Table 7, this study analyzes the direct effect of learning agility and transformational leadership on digital technology innovation adoption and the impact mediated by transformational leadership towards the nexus between learning agility and adoption of digital technology innovation. The results in Table 5 and Figure 2 show that based on the analysis in Table 2, p-value of 0.05 was obtained. Based on the research, the results of the impact show a p-value < 0.05, which shows that H1 ($t = 7.203$, $p = 0.000$) and H2 ($t = 4.321$, $p < 0.000$) indicate that learning agility and transformational leadership have a positive and significant influence on the adoption of digital technology innovation. As a result, the learning agility of employees is needed to adopt digital technology innovation, and transformational leadership has an important influence on employee's adoption of digital innovations. Furthermore, this study examines transformational leadership as a mediator in the relationship between learning agility and adoption of digital technology innovation.

Table 7. Hypothesis Result

Causal Relationship	Original Sample	Sample Mean	STDEV	t-Value	p-Value	Conclusion
Direct Effect						
LA → ADTI	0.357	0.363	0.050	7.203	0.000	Accepted
TL → ADTI	0.273	0.275	0.053	4.321	0.000	Accepted
Mediation Effect						
LA → TL → ADTI	0.82	0.085	0.026	3.200	0.001	Accepted

Note: LA, Learning Agility; TL, Transformational Leadership; ADTI, Adoption to Digital Technology Innovation.

The results in Table 7 and Figure 3 reveal that H3 ($t = 3.200$, $p < 0.001$) has a relationship mediated by transformational leadership. Significant results show that transformational leadership will affect employee's learning agility in adopting digital technology innovation in an organization.

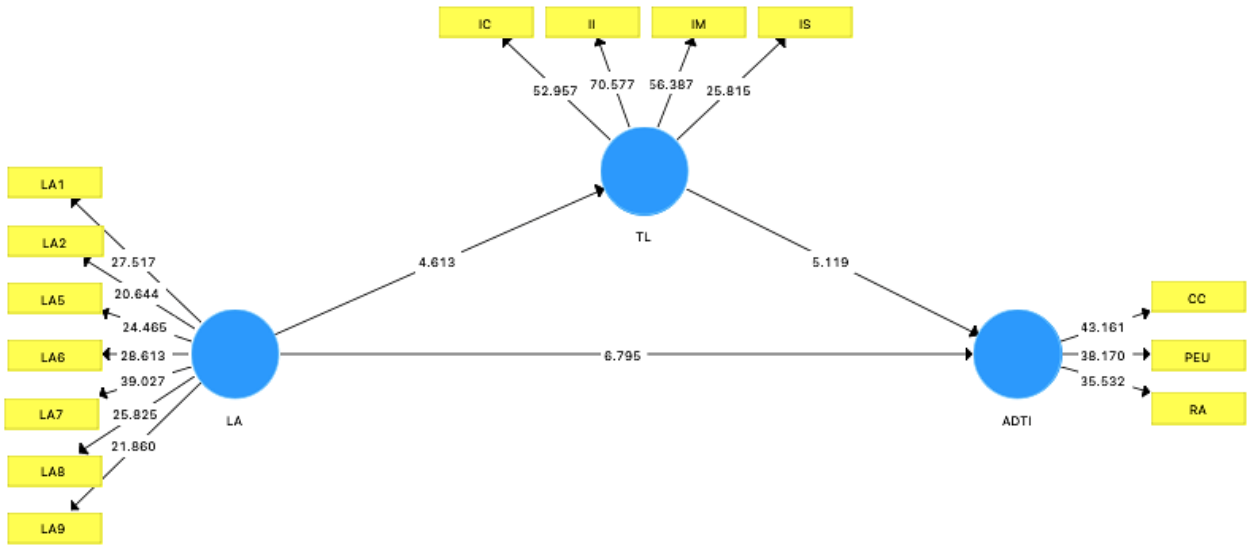

Figure 3. The Structural Model

5- Discussion

This study seeks to examine employee's learning agility as one of the dynamic capabilities and transformational leadership appointed as mediators to influence employees to adopt digital technology innovation, specifically for Indonesian micro, small, and medium-sized enterprises (MSME). Learning agility is one of the skills required to adapt to change, particularly when incorporating digital technology innovations. The study's findings indicate that learning agility has a positive and significant effect on the adoption of digital technology innovations. Similarly, transformational leadership has a positive and significant effect on the adoption of digital technology innovation. In addition, transformational leadership in adopting digital technology innovation, which is designated as a mediator, has a positive and significant effect on the nexus between employee learning agility and the adoption of digital technology innovation.

Based on the findings of this investigation and the identified relationships among variables, a hypothesis is formulated. First, the findings reveal that acquiring agility as a dynamic capability provides a positive and significant impact on the adoption of digital technology innovations. Consistent with prior research, the study identifies that learning agility as one of the skills necessary for employees to adapt and cope with changes in the digital age [75]. This acknowledges that an individual's learning agility in adapting to new circumstances is possible because this capability enables individuals to learn from experience when adapted to new circumstances and enables the individual to act with the appropriate attitude in response to the circumstances. In light of the changes that have occurred in the digital era, the learning agility capability is crucial.

Second, transformational leadership has a significant and positive effect on the adoption of digital technology innovation. Literature has demonstrated the importance of leadership in organizations in adapting to change, so that the role of the leader facilitates the adoption of new technological trends, particularly in industry 4.0 [52, 93, 112]. This study corroborates prior research indicating that transformational leadership had the capacity to exert influence over followers and guide them in effectively adapting to digital change [17]. Transformational leadership is believed to inspire, motivate, and encourage followers to achieve the desired outcomes. Transformational leadership styles have been demonstrated to have a positive effect on employees' ability to achieve organizational objectives, particularly in the context of employing digital innovation.

Finally, as a mediator of the nexus between learning agility and the adoption of digital technology innovation, leadership plays an important role. The important role of transformational leadership as a mediator is demonstrated in this study. The findings in this study indicate that transformational leadership styles mediate the nexus between learning agility and the adoption of digital technology innovations. These results show that while dealing with changes in the digital age, MSME in Indonesia should consider the value of transformational leadership inside their companies since leaders can ease the process of individuals embracing digital innovations. Consistent with these findings, transformational leadership is believed to have the potential to act as a mediator in the successful implementation of new technology. This suggests that followers who are increasingly motivated and inspired by their leaders will experience less difficulty in adopting and utilizing new technology [113]. Thus, in an effort to maximize the desired results when adopting digital innovation, a leadership role is needed. Therefore, the transformational leadership style plays an

important and valuable role as a mediator while understanding the implications of the nexus between learning agility and the adoption of digital technology innovation in organizations.

6- Contribution of the Study

We underline that learning agility can have an impact on individuals adoption of digital technology innovations. Learning agility acts as an ability to adapt to new environments. Nonetheless, learning agility towards the adoption of digital technology innovations must be considered one of the capabilities needed for change, especially in digital transformation. Furthermore, transformational leadership has a role in integrating individual capabilities towards the adoption of digital technology innovations. This research provides a special description of learning agility as one of the special capabilities that is appropriate for understanding how important this capability is in adopting digital innovation as a practical contribution.

In addition, the practical contribution of the transformational leadership style is needed to facilitate change, especially when adopting digital innovation. The role of transformational leadership in the adoption of digital innovation is to influence individuals in an effort to utilize individual learning agility abilities towards the adoption of digital technology innovations. So that MSMEs in Indonesia are expected to be able to maximize the role of transformational leadership and the role of individual learning agility in dealing with changes in the digital era.

Theoretical findings suggest a relationship between learning agility and transformational leadership in adopting digital technology innovations. This research presents academic contributions to organizations dealing with changes in the digital era. The importance of studying learning agility as one of the abilities possessed to adopt digital innovations should not be ignored by researchers. This study identifies how important the role of learning agility skills and the role of transformational leadership in MSMEs is in adopting digital technology innovation and dealing with industry 4.0 transformations as well as provides implications for practitioners and policymakers in all nations seeking to develop digital technology-driven competitiveness.

7- Conclusion

This study effectively combines the concepts of learning agility and leadership variables to explain how they can influence the implementation of digital technology innovation in MSMEs. The data in this study were examined utilizing a structural model equation methodology. Through the examination of the structural model equation, it has been determined that learning agility has the potential to facilitate the adoption of digital technology. This competence enables businesses to effectively adapt and confront change. Moreover, leadership is regarded to have the capacity to drive organizational adaptation to digitalization by inspiring, motivating, and encouraging followers to attain desired objectives. Moreover, leadership plays a crucial role as a mediator in the connection between learning agility and the adoption of digital technologies. This demonstrates that transformational leaders enhance employees' capacity to acquire new knowledge and adjust rapidly, while also establishing a conducive atmosphere that fosters innovation and facilitates change. Transformational leadership enhances the favorable impact of learning agility on the adoption of digital technologies by offering a clear vision, support, and motivation. These findings emphasize the significance of cultivating transformational leadership inside businesses to expedite the process of digital transformation and enhance the competitiveness of micro, small, and medium enterprises (MSMEs).

The research findings unveiled numerous novel prospects for future investigation. This study examines how the relationship between learning agility predicts the Indonesian MSME employee's adoption of digital technology innovation and how transformational leadership mediates this relationship. First, this study focuses solely on employees' cognitive domain, which is learning agility. Obviously, in the cognitive domain, it is not sufficient to examine the ability of employees to recognize the link between learning agility and digital technology innovation adoption. In addition, tolerance to failure, critical thinking, purpose orientation, conveying messages, acting ethically, and information gathering need to be evaluated in the future to conclude the identification of the relationship between employee capabilities in the cognitive domain and the adoption of digital technology innovations. Second, this study discusses the relationship between transformational leadership and digital innovation adoption, as well as the role of transformational leadership as the mediator of the relationship between learning agility and digital technology innovation adoption. Transformational leadership, through its sub-dimensions, namely individual consideration, intellectual stimulation, inspirational motivation, and idealized influence, is able to stimulate creativity and ingeniousness in generating new business ideas. However, innovative leadership, transactional leadership, and other leadership styles also need to be evaluated as mediators in adopting digital technology innovation. Finally, this study focuses on followers' perspectives on digital technology innovation adoption. In future scenarios, researchers are expected to be able to examine management perspectives on adopting digital technology innovation within organizations.

8- Declarations

8-1- Author Contributions

Conceptualization, C.L.C. and E.O.; methodology, E.O.; software, E.O.; validation, C.L.C. and E.O.; formal analysis, C.L.C.; investigation, C.L.C.; resources, E.O.; data curation, E.O.; writing—original draft preparation, E.O.; writing—review and editing, C.L.C.; visualization, E.O.; supervision, C.L.C.; project administration, E.O.; funding acquisition, C.L.C. All authors have read and agreed to the published version of the manuscript.

8-2- Data Availability Statement

The data presented in this study are available on request from the corresponding author.

8-3- Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

8-4- Institutional Review Board Statement

Not applicable.

8-5- Informed Consent Statement

Not applicable.

8-6- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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Appendix I

Variables	Dimensions	Code	Items
Learning Agility		LA1	I am a curious and inquisitive person
		LA2	I am able to accept other people's suggestions and act
		LA3	I am a flexible person (able to adapt when plans don't work out)
		LA4	I am a self-aware person (knowing my own strengths and weaknesses)
		LA5	I demonstrate a desire to gain new knowledge and skills
		LA6	Personally, I am a person who wants to grow and develop
		LA7	I seek new challenges and experiences
		LA8	I am an open-minded person and accept change and new ideas
		LA9	I reflect and learn from mistakes
Transformational Leadership	Idealized Influence	II1	Our leaders share a clear vision for improving quality
		II2	Our leaders have the ability to anticipate change and plan to accommodate change
		II3	Our leaders encourage their employees to use the latest technology to improve product and process quality
		II4	Our leaders accept suggestions from their employees when planning and implementing quality improvements
	Inspirational Motivational	IM1	Our leaders always motivate their employees to take necessary actions to improve quality
		IM2	Our leaders encourage their employees to complete tasks and responsibilities
		IM3	Our leaders emphasize on improving quality rather than cost.
		IM4	Our leaders' express confidence that goals will be achieved if leaders and employees work in harmony
	Intellectual Stimulation	IS1	Our leaders reexamine critical assumptions to question whether they reflect organizational policies
		IS2	Our leaders seek different perspectives to solve problems
		IS3	Our leaders seek new business ideas
		IS4	Our leaders strive to maintain quality
	Individual Consideration	IC1	Our leader takes the time and effort to educate his employees
		IC2	Our leader strives to improve the quality of the organization's work
		IC3	Our leader encourages his employees to integrate quality to achieve organizational goals
		IC4	Our leader encourages that individual employee goals and organizational goals should be integrated to achieve better quality
Adoption to Digital Technology Innovation	Compatible	C1	Digital technology fits most aspects of my work
		C2	Digital technology fits my work style
		C3	Digital technology fits my lifestyle
	Relative Advantage	RA1	Digital technology allows me to complete tasks faster
		RA2	Digital technology improves the quality of the work I do
		RA3	Digital technology makes my job easier
		RA4	Digital technology improves my job performance
		RA5	Overall, I find digital technology to be beneficial to me in my job
		RA6	Digital technology improves my effectiveness in my job
		RA7	Digital technology gives me more control over my work
		RA8	Digital technology improves my productivity
	Perceived Ease of Use	PEU1	Digital technology makes it easier for me to do whatever I want to do
		PEU2	Overall, I believe digital technology is easy to use
		PEU3	Learning to operate digital technology is easy for me