From adoption to adaptation: Bridging digital transformation and AI integration in contemporary SMEs

Hsiang An Hu

Hsiao-Ting Tseng

Jian Mou

Jongki Kim

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Hsiang An Hu [1]
Hsiao-Ting Tseng [2,*]
Jian Mou [3,*]
Jongki Kim [4]

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*Corresponding author
[1] National Central University, Taoyuan, Taiwan, tn00313445@gmail.com [2] National Central University, Taoyuan, Taiwan, httseng@mgt.ncu.edu.tw
[3] Pusan National University, Busan, South Korea, jian.mou@pusan.ac.kr [4] Pusan National University, Busan, South Korea, jkkim1@pusan.ac.kr

ABSTRACT

In today's rapidly evolving business landscape with prevalent uncertainties, firms seek innovative strategies to remain competitive and sustainable. The ascent of digital transformation and artificial intelligence (AI) presents both opportunities and challenges, emphasizing swift adoption and adaptation. SMEs risk further losses by solely focusing on the advantages of new technologies without addressing organizational adaptability and culture. This strategy cannot simply be mirrored from larger enterprises. This study offers a two-phase exploration of the interplay between digital transformation and AI integration. The first phase, informed by literature and qualitative research, crafts a digital transformation strategy. The subsequent phase, through mixed-method case studies, assesses enterprise readiness for AI, resulting in a strategic model validated by industry practices, benefiting enterprise management and AI integration. This study highlights the critical linkage between digital transformation foundations and AI adoption readiness in SMEs, providing strategic insights based on a two-stage research approach.

Keywords: Digital transformation, Artificial intelligence, Readiness, Adoption, Adaptation

INTRODUCTION

Economist Schumpeter (1939) said: "Economic development can only be achieved through creative innovation and change." In the contemporary business environment of rapid transformation and pervasive uncertainty, businesses are constantly striving to develop innovative strategies and approaches to maintain a competitive advantage and ensure sustainable growth.

From the perspective of sustainable business management, neither individuals nor organizations are only satisfied with the advantages and conveniences brought by the current digital transformation. Therefore, continuous growth is necessary. Since 2020, as artificial intelligence (AI) technologies anchored in big data have advanced, businesses in diverse sectors have increased their attention to the application of AI. For example, in the "Sustainable Development Report for Fiscal Year 2021" (2021) released by Taiwan Semiconductor Manufacturing (TSMC), the previous digital transformation strategy has evolved, and now it is vigorously promoting smart manufacturing. Digital transformation is divided into three stages at TSMC: The first stage emphasizes three kinds of automation of machine, material transfer and wafer scheduling; the second stage integratesdata analysis of wafer big data, machine learning techniques and domain-specific knowledge database; and the current third stage focuses on the realization of AI integration. A company's past digital transformation experience plays a key role in determining the efficiency and effectiveness of a company's adoption of AI, which also depends on how much benefit the company can achieve after the adoption of AI.

While companies are initially adopting AI as the first step to digital transformation, they still face broader organizational adaptability issues. Moreover, although both areas of digital transformation and AI have been extensively studied recently, there are also studies that have highlighted the importance of digital transformation and AI technologies for enhancing business processes, customer experience (Baiyere et al., 2020; Sahu et al., 2018) and decision analysis (Metcalf et al., 2019). However, gaps still exist and need to be further explored.

The rise of digital transformation and the development of AI have undoubtedly brought unprecedented opportunities and challenges. The organization's capacity to adapt to these novel work modalities is a primary consideration. While having big data and sophisticated computational systems might suffice for technical AI integration, an exclusive focus here might overlook the need for cultural and organizational adaptability, which might involve employee distrust due to the lack of transparency of emerging technologies (Holmström, 2022) or fears of job displacement (Agrawal et al., 2019). In order to avoid the adaptive problems derived from the above-mentioned organizational changes brought about by AI, this study further explores how to ensure organizations are fully prepared for the major changes to come when adopting these emerging technologies. In addition,

while existing research usually focuses on large enterprises, the prospects for digital transformation and AI applications in small and medium enterprises (SMEs) may be different. Due to limitations such as limited infrastructure and scarce resources, it is facing challenges to achieve phased and stable digital transformation. Large enterprises such as Netflix, Google, and Amazon provide practical and successful directions with their innovations in digital technologies and AI (Kepuska & Bohouta, 2018; Ram et al., 2018; Maedche et al., 2019). How SMEs can overcome the disadvantages brought about by the size of the enterprise through digital transformation is still a research gap that we aim to bridge. Therefore, the prompt adoption and seamless adaptation to these technological shifts emerge as critical business concerns.

Based on the above research background and gaps, this study aims to explore two research objectives: (1) To explore modern SMEs' digital transformation strategies by gain insights from senior executives on AI adoption to understand the prerequisites for digital transformation adoption and the value expected of it, to frame a strategic framework. (2) To validate the proposed digital transformation strategic framework through industry practices, emphasizing the correlation between the maturity of digital transformation and AI adaptation, providing comprehensive strategic recommendations.

LITERATURE REVIEW

Digital Transformation
The foundation of digital transformation lies in digitalization, which entails converting raw data, such as sound, images, and text, into digital formats. This facilitates cost-effective and convenient storage, replication, transmission, and processing (Chen,2019). Digitalization is perceived as leveraging digital technologies to innovate business models and usher in new avenues for value creation and revenue generation (Verhoed et al., 2021). This phase is commonly seen as transforming into a digital business by utilizing digital al technologies and information to alter business operations (Muro, Liu, Whiton, & Kulkarni, 2017). Typically, digitalization primarily targets operational aspects of the business realm rather than social interactions and business models, although these elements are intrinsically related.

The term "transformation" refers to the alteration of an enterprise's longstanding organizational structure, resource allocation, and strategic direction to reforge its competitive edge (Reeves et al., 2018). "Digital," on the other hand, alludes to digital tools employed for this transformation, including artificial intelligence, blockchain, and big data (Chan et al., 2020). Combining these concepts, digital transformation can be defined as a paradigm shift in an enterprise's value proposition driven by digital technologies. Through digital transformation, both the organizational planning and operational methods of an enterprise are radically restructured (Reis et al., 2018). This enables managers to integrate emergent technologies into their business models, thereby reshaping corporate strategy to enhance adaptability within both the business and broader environment. By leveraging organizational agility and rapid business capability development, enterprises can achieve strategic advantages in this data- driven era.

AI Adoption and Readiness
The successful implementation of AI in enterprises necessitates a foundational technical infrastructure, which includes computational capabilities, storage capacity, and networking facilities to sustain AI applications. Additionally, the ability to adapt is crucial. Enterprises require technical professionals and AI experts who can adjust to ever-evolving technologies and their applications (Jöhnk et al., 2021). These skilled personnel are essential for effectively leveraging AI advancements. Moreover, data readiness is crucial. Enterprises must possess extensive, high-quality datasets and ensure robust data management and privacy safeguards (Issa et al., 2022). Talent acquisition is another vital component: enterprises require technical professionals and AI experts to adapt to ever-evolving technologies and their applications (Jöhnk et al., 2021). Additionally, managerial support is indispensable, necessitating clear AI strategies and management protocols to ensure the successful deployment of technology (Fountaine et al., 2019). Otherwise, once an organization introduces a new technology, there's a possibility that due to the reorganization of operational processes and workforce planning, it might find it difficult to adapt or even be unable to operate for a while, resulting in a decrease in efficiency.

The key motivators for AI adoption are enhanced efficiency, cost reduction, increased innovation, and a competitive edge (Hossain et al., 2022). However, as the adoption rate escalates, so too do the associated challenges, encompassing technical proficiency, technological familiarity, data quality issues, security threats, and legal and ethical concerns (Kushwaha & Kar, 2020). Furthermore, societal aspects must be taken into account when adopting AI. These include employee concerns about AI replacing jobs, the ramifications of AI on employment opportunities, and the public's acceptance of AI technologies (Cubric, 2020).

Therefore, when considering the adoption of AI, businesses must comprehensively assess the drivers, barriers, and societal impacts to optimize adoption outcomes. Overall, the adoption of AI reflects the trend of contemporary enterprises to improve efficiency and competitiveness. However, before adopting AI technology, enterprises must thoroughly evaluate and refine organizational culture, data quality, business model, and business strategy (Kushwaha & Kar, 2020).

METHODOLOGY

Research Design
This study explores the process enterprises undergo during the digital transformation phase and its implications for adopting AI technology. A two-stage qualitative research and case study approach employed to achieve this, providing further insights.

Stage 1: Adoption of Digital Transformation in SMEs

In the first stage, this study investigates the impacts and transformations that the introduction/adoption of digital transformation brings to the organizational structures of SMEs. To address this issue, using the qualitative method, the existing literature on enterprise digital transformation is first analyzed. The study begins with the preliminary integration of digital transformation strategies and technological adoption. It understands organizational decision-making behaviors, internal operational dynamics, and strategies for successful transformation. Integrating the aforementioned aspects to enhance customer experience was also reviewed. Existing literature on organizational digital transformation indicates that senior executives emphasize enhancing customer experience, streamlining internal processes, and the advent of innovative service models as pivotal in the transformation process (Bahram, 2018). Hyvönen (2018) suggests that digital transformation planning and strategic deployment by senior managers within the organization are crucial determinants of successful transformation. Lichtenthaler (2020) argues that the successful digital transformation of an organization depends on leveraging emerging technologies such as big data and AI to reshape organizational behavior. Therefore, the qualitative research in the first stage formulates interview questions categorized into background, decision analysis, internal operations, transformation strategies, customer experience, and the benefits of transformation (as shown in Table 1).

Table 1: Interview topics for digital transformation of enterprises.

Topic.	Content	References
Background	1. Demographics 2. Industry environment 3. Strategic plans of enterprise 4. Internal changes in the enterprise	Chien, 2019; Matt, Hess& Benlian, 2015; Westerman, Bonnet & McAfee, 2014
Decisionanalysis	1. Identifying new profit opportunities 2. Exploring innovative cost-reduction strategies 3. Adapting for environmental changes	Hyvönen, 2018; Lichtenthaler, 2020; Provost & Fawcett, 2013
Internal operations	1. Talents specialized in digital transformation 2. Transforming, integrating, or establishing new departments throughdigital transformation 3. Establishing performance metrics to evaluate the outcomes of digital transformation strategies	Provost & Fawcett, 2013; Westerman, Bonnet & McAfee, 2014; Gurbaxani & Dunkle, 2019
Transformation strategies	1. Innovation management and operations across organizationaldepartments 2. Allocating a proportionate investment in the realm of digital transformation 3. Building more collaborative partnerships to generate additional benefits 4. Experimenting with novel working methodologies	Lichtenthaler, 2020; Hyvönen, 2018; Hellbe & Leung, 2015; Kane et al., 2015
Customer experience	1. Recognizing shifts in customer demands 2. Evolution in promotional and marketing strategies 3. Designing the customer experience journey	Chalabi, 2018; Tabrizi etal., 2019
Benefits of transformation	1. Achievements in brand marketing 2. Enhancing workflow efficiency 3. Boosting customer satisfaction	Chanias, 2017; Hyvönen, 2018; Hellbe & Leung, 2015; Pousttchi et al., 2019; Chalabi, 2018.

Source: This study.

Stage 2: Adaptation of AI in Enterprise

AI, an emerging and maturing research domain, has seen rapid advancements predominantly pushed by the private sector (Wirtz & Müller, 2019). However, examples of the comprehensive and successful integration and transformation of AI into organizations are lack of deeper discussion. Therefore, the second stage employ a mix-medthod, focusing on enterprises that have shown promising digital transformation outcome in the first stage. This stage aim to determine organizational readiness in adopting AI technologies, thus we integrates case studies with qualitative interviews of senior executives. This assessment is based on hierarchical dimensions that measure readiness for AI technology adoption (Alsheibani et al., 2018). These dimensions are categorized as Technical Readiness (TR), Organizational Readiness (OR), and Environmental Readiness (ER). TR assesses the propensity of organizations to accept and use new technologies, which is crucial for the application and development of AI (Flavián et al., 2022). This includes internal technological infrastructure and the state of prevailing technologies in external markets (Martínez -Plumed et al., 2021), helping enterprises predict the benefits of technology adoption. OR indicates an organization's ability to embrace technological change and should be viewed from the perspectivesof leadership, culture, organizational structure, talent, and technological infrastructure. This ensures that new technologies fullyrealize their value and advantages (Pumplun et al., 2019). ER represents an organization's preparedness to consider environmental impacts before adopting new technologies, taking into account cultural, political, and legal aspects. This emphasizes the adaptation of the organization in response to the external turbulent environment. Based on the existing literature, this study further identifies each topics based on these three dimensions to explore the corresponding adaptation strategies (as shown in Table 2).

Table 2: Interview topics for adaptability of enterprises to AI adoption.

Topic.	Content	References
Technical Readiness (TR)	1. Relative Advantage 2. Compatibility	Chang *et al.*, 2020; Flavián *et al.*, 2022
Organizational Readiness (OR)	1. Supervisor support 2. Organizational size 3. Internal resources	Collins 2021; Jöhnk *et al.*, 2021; Pumplun *et al.*, 2019
Environmental Readiness (ER)	1. Competitive pressure 2. Government regulations	Gutierrez *et al.*, 2015

Source: This study.

Data Collection

In the first stage, one-on-one semi-structured interviews were conducted with senior executives from 30 SMEs in Taiwan. Each interview was about within a duration of 30 to 40 minutes. The discussion focuses on the current industrial status of the digital transformation of modern enterprises, establishes a research framework for the strategic deployment of digital transformation, and provides reference for practical applications. At the same time, the enterprise with the highest readiness for AI adoption was chosen for further investigation in stage 2. Finally, the case enterprise (Company A) belonging to the technology industry was selected for the second stage.

Company A offers testing and validation services across various sectors, including component industries, consumer electronics, and the automotive sector. It acts as a significant collaborator and quality gatekeeper in multiple domains. Company A adopts a variety of digital technologies and equipment, and ensures impartial verification to guarantee products have undergone reliability testing and failure analysis before they go on the market. Company A exhibits comprehensive digital transformation outcomes given its services and operational model. Semi-structured interviews focusing on the three dimensions of AI readiness will be conducted with senior managers from departments highly associated with AI adoption of Company A. The duration of interviews is controlled at around 30 to 40 minutes. Based on these research findings, a strategic model for 'AI adaptation in digital transformation' will be developed. Then, it is validated by empirical data.

FINDINGS AND DISCUSSION

Adoption Strategies of Digital Transformation in SMEs

Before undertaking digital transformation, executives should carefully evaluate three dimensions of the enterprise: An external **environmental evaluation**, including market trends and competitors' behaviors; **internal evaluation** of employees' understanding of digital technologies and the level of digitization of data and tools; and **customer-relationships** evaluation involves observing changes in customer needs and planning the customer journey.

The product market in Taiwan is generally characterized by a small size, leading to intense competition. Enterprises are keen to pioneer new product development or innovative service models to stand out from competitors. A key element of thiscompetitive landscape is the ability to leverage information. As mentioned by an advertising agency manager "*From my experience in the industry, I've seen how the global landscape has shifted. With the rise of the digital age and the use of big data, we, as managers, need to keep up with changing trends, market shifts, and evolving consumer behaviors. It's especially important to understand how consumers interact with things like smart devices, digital media, and social platforms. Getting a grasp on their habits and behaviors helps us get a clearer picture of their decision-making process. Through **big data analytics techniques**, we can gain a better understanding of their habits and behaviors, which aids us in gaining a clearer insight into their decision-making. That way, we can tailor our marketing strategies to align better with their needs and actions*". It showed only when enterprises obtain massive and diverse information they can formulate transformation strategies that are both innovative and risk-averse. Many executives believe that in addition to mastering the technology of information utilization, they must acquire knowledge from a wider range of fields. Another HR representative from a different advertising company said, *"We have been hiring more technical talents who possess not only digital-related skills but also soft skills such as critical thinking and business acumen. These individuals can serve as internal seeds, generating guidance on educational and operational aspects."* We can also observe that by hiring employees who are proficient in these **new technologies and knowledge**, or by collaborating with industry across sectors, thereby expanding the range of decision-making options to achieve **innovative products and services**, gaining a strong competitive edge.

For enterprises, the tangible impact of digital transformation can be distinguished by examining the **changes in organizational behavior** brought about by digital technologies. Most enterprises that have either completed or are undergoing digital transformation demonstrate a shift in organizational behavior. The integration of digital technology, both in terms of software and hardware, anchors the foundation for **digitalization and digitization** within the organization. This facilitates the simplification and standardization of **internal operational processes**. As said by an interviewed company CEO, *"The majority of our management systems are already in a digitized state. Internally, data management and platform development, as well as customer interaction and service at the front end, have all benefited from this digitalization. It has also facilitated the rapid implementation of our ERP system, significantly shortening many of our daily processes."* Furthermore, to ensure that

employees' competencies align with the adopted tools and workflows, organizations frequently offer technical training tailored to these newly implemented software and hardware solutions, thus ensuring that the organization possesses a substantial level of **digital foundation** in both its technological infrastructure and workforce. As said by one of the interviewed managers in insurance industry *"We're in the sales department and have this system called the "57 Reports." It covers everything from our daily tasks and training to performance results. All our salespeople have to input their data daily, and the system sorts and calculates everything for them. It's been a game-changer for us. Our company invested a lot in developing it. Not only do we use it here in Taiwan, but our branches in mainland China use it too. Considering China's vast geographical scope, this system is especially important when our branches in mainland China need to share and integrate data."* Especially for enterprises with a lot of business activities, on-job training for applications such as CRM, ERP, financial management, and cloud systems is crucial. These **enterprise management systems** ensure that new technical capabilities can be swiftly integrated, replacing previous operational methods. As stated by two interviewed CEOs from technology companies, *"It's crucial that all members of the organization maintain a habit of continuous learning in order to swiftly adapt to these new work methodologies following the implementation of new technologies."* Additionally, one CEO noted, *"Our team members arealready well-versed in digital work patterns, so when new technologies are introduced, their receptiveness is high, and their adaptation is remarkably swift."*

The main goal of companies undergoing digital transformation is to **find new avenues of profit**, whether it is to reduce costs or develop new revenue streams. Most enterprises leverage digital technologies to **consolidate resources or platforms**, eliminate redundant processes, reduce personnel costs, and enhance operational efficiency. The founder of a certain chain of coffee shops also mentioned, *"I introduced a POS system at the beginning of 2020. It's cloud-based and enables real-time analysis, allowing me to remotely organize marketing activities for employees. It also **integrates systems from other platforms**.After merging our delivery and mobile payment systems, we significantly streamlined many of our previous processes."* This need was especially evident during the impact of COVID-19. *"The old way of doing things was pretty inefficient and often inaccurate. When everything was on paper, we constantly faced these issues Such as passing information was slow, and duringthat process, there'd be delays and mistakes. But after going digital, many of these problems were solved. With a solid digital setup, information can be shared way faster and more accurately. The benefits of digital transformation are really clear in this."* said by a technology company manager. Traditional processes such as physical document signing, submission andreview can become more time-consuming if they still rely on paper and manual delivery. Such inefficiencies could significantly impact customer retention and renewal rates. Therefore, the widespread adoption of digitally encrypted electronic contracts and online purchase or renewal mechanisms on digital platforms can create more business opportunities and reduce unnecessary commuting by employees. At the same time, this also enhances operational efficiency and **improves the modes ofservice or product delivery**, resulting in a better experience for customers.

As various digital systems and technologies are integrated into enterprises, the tangible results of digital transformation will be reflected in **customer experience**. The Chief Operating Officer of a certain company expressed, *"When it comes to customer experience, from a digital perspective, it's about user experience. At times, customers using our platform may not attain the desired experience. As a result, we continually engage with customers to gather data on this user experience. After analysis and confirmation, we can present what's known as the User Interface (UI), enabling customers to become familiar and swiftly adapt to the platform. This not only helps us maintain a close relationship with customers but also fosters their loyalty towards us."* By leveraging digital tools to collect data from customers and subsequently analyzing that data, enterprises can realize consumer behavior and habits. This enables them to **anticipate and offer corresponding products or services** even beforethe customers recognize their needs, Or design special marketing campaigns based on data, such as new product launches or promotions, in order to **maintain customer loyalty and engagement**. Furthermore, these insights can facilitate the **expansion of new customer segments**, enabling businesses to be well-prepared to enter previously untapped markets with lower risks. Similarly, as expressed by another interviewed manager from a health technology company, *"Online platform-centric e-commerce models are also evolving into the mainstream. We can transform products into 3D representations, refreshing how they are presented to appeal to a broader customer base. Moreover, in the B2C sales domain, data-driven Martech allows for more refined customer segmentation. This optimization not only enhances customer retention rates but also facilitates lower-risk and swifter expansion into new markets."* Compared with data-driven decision-making, making decisions based solely on traditional empirical indicators is like looking only in the rearview mirror while driving, blurring the path and direction ahead. Such a narrow focus also hinders organizations' ability to prepare for and adapt to emerging innovations, such as adaptation issues in second-stage AI technologies, e.g., environmental readiness, organizational readiness and technical readiness.

It can be seen that the current digital transformation has laid a basic framework for the integration of AI technology within the enterprise. If an enterprise wants to achieve sustainable and long-term growth (as shown in Figure 1), at the initial stage of digital transformation, it is necessary to carefully evaluate the internal and external environment of the enterprise and the current status of customer relationships. They can enhance their competitive edge by swiftly incorporating emerging technologies and knowledge. This enhancement not only improves organizational operations and uncovers new avenues of profit, but also improves customer relationship management on the business side. The accumulated benefits are used as feedback to further enhance the competitiveness of enterprises and make them more adaptable and resilient to cope with changing environments, technological advancements and competitive challenges. Once AI technology is introduced, it will bring about significant changes both internally and externally within the organization. Many aspects of manpower, processes, and resources will require a thorough reassessment. We can interpret this scenario as a major environmental upheaval, where

organizations with a strong foundation in digital transformation possess the ability to quickly absorb and adapt to entirely new technologies and changes. This allows them to rapidly enhance their competitiveness while mitigating risks, ultimately achieving the goal of sustainable operations.
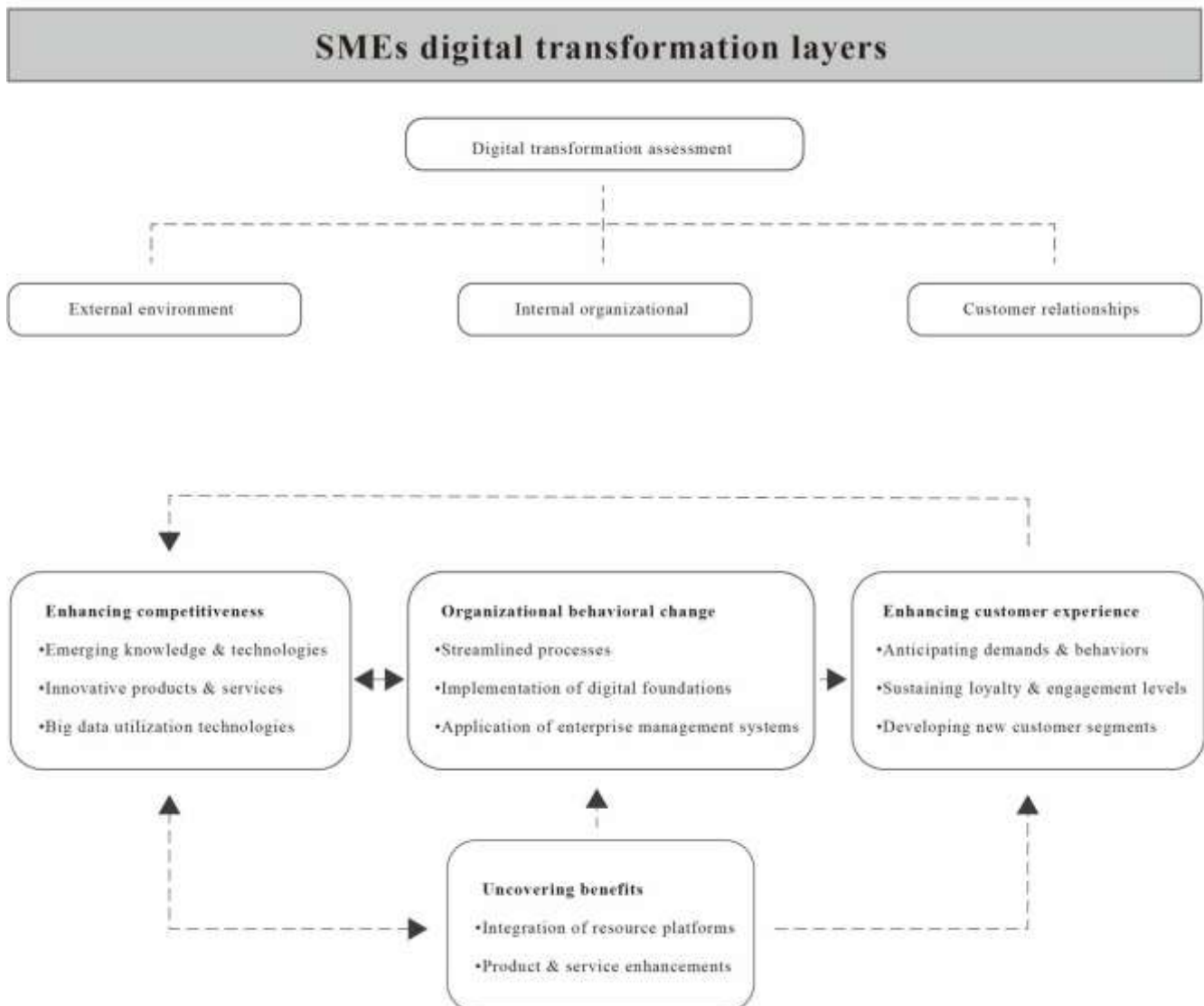

Figure 1: Adoption of Digital Transformation Strategy Framework

Adaptation of AI in Enterprise
When enterprises consider adopting AI technology, the **surrounding environment** often plays a key role. Especially in times of increased competition in an industry, there tends to be a strong drive to embrace new technologies. As stated by the R&D manager of Company A, *"GPT has sparked a trend across the entire internet, making it feel outdated if one hasn't utilized it. I believe such a trend will also drive us to incorporate artificial intelligence."* However, most businesses, especially SMEs, do not yet have the technical capabilities to effectively utilize AI. Hence, senior decision-makers are in a high-pressure observational mode. Any **keen market demand** may represent an opportunity to pioneer new technological advancements within the industry, thereby increasing the competitive advantage of the enterprises. Meanwhile, as Company A's engineering manager points out, *"If our competitors are already adopting this trend, it could greatly affect us. Hence, we need to monitor how extensively our rivals are employing AI."* The level of AI implementation among competitors will also be a key area of focus. As mentioned earlier in the context of digital transformation, many countries have developed comprehensive policies to promote digital transformation technologies. Its goal is to synchronize digital transformation efforts between enterprises and government entities to modernize urban society, promote industrial progress, and enhance national economic competitiveness. R&D Manager in Company A considered "*If the government gives incentives and support, I believe companies will definitely go down that path. I totally agree from my perspective. It's like riding along with the government's policy, and it might even give us a boost in marketing.*" If a **policy to encourage the development of AI** is introduced, it is likely to cause enterprises to respond positively and formulate an AI technology integration strategy.

After ensuring adequate external and environmental readiness, the internal readiness of the organization becomes a key aspect of the second stage assessment. This includes factors such as **senior management support** and planning as well as human

resources and digital assets within the organization. This stage critically influences whether integrating AI yield significant benefits for the enterprise. Senior management endorsement plays a salient role in determining **AI implementation strategies**, **resource allocation**, and **risk management**. Engineering Manager in Company A said "*Our boss has told us that if we have any needs or ideas, we should bring them to the team. Of course, they'll be scheduled based on priority and urgency. So, in general, the boss support us diving into AI stuff.*" Data manager in Company A also mentioned, *"If I propose AI-driven decisions, such as hiring relevant talent, it can save the company a lot of costs and bring new opportunities. Typically, the bosses are fully supportive as they are also highly interested in this aspect."* In other words, lack of AI technical knowledge among senior executives can lead to decision-making indecision, potentially leading to impractical or unattainable visions that could diminish organizational morale.

Operation Manager in Company A said "*We don't need to bring AI into every department in our company. Each one has its own way of doing things. Just because you adopt and use AI doesn't mean it'll be more efficient. The time and challenges faced when introducing AI can vary, leading to different outcomes in different situations.*" The decision to integrate AI isn't just based on the size of a department or its volume of business. The data manager at Company A shares a similar viewpoint: *"I believe the implementation of artificial intelligence is closely tied to the operational models of various departments. It doesn't necessarily mean that smaller units don't need it or that larger ones always do. The key factor is alignment with the operational model. If their department's workflow is conducive to it, such as in cases of high repetition, we can find elementsof automation or artificial intelligence to assist them. However, if their tasks involve highly variable attributes requiringhuman testing, then using AI technology wouldn't be suitable as a replacement."* The resources available within the different organizational units must first be determined. The **evaluation and reconfiguration of hardware and software should be included** in strategic planning for AI adoption. Senior executives should work with technical teams to determine whether upgrading or replacing existing equipment is necessary to ensure they are adequately prepared to maintain the operations and growth of AI applications. This may involve purchasing high-performance servers, massive computing power and expanded data storage capacity. At the same time, the selection of software tools and platforms should consider meeting the specific requirements of AI applications.

Technical readiness can be considered the last step in integrating AI technologies, and arguably the most critical assessment. This level of readiness determines whether a company can quickly adapt and replace existing operating methods when AI is integrated. The stability, efficiency and scalability of the technology, especially in the initial stages of integration, will affect the **efficiency and cost reduction** results of AI, bringing risks of project failure and waste of resources. "*We must first understand what AI can do for us and how far its tech goes. ... can we integrate reports into AI? Who can help us with this? That's what we should be focusing on first. We should see if we can use the company's resources and feed our current information into AI for analysis.*" as the operation manager mentioned. For example, while AI-driven robots and virtual assistants can enhance customer service and operational efficiency to some extent, the absence of a precise understanding of employee and customer needs, coupled with appropriate functionalities, could yield counterproductive results. Especially whenerrors in understanding occur in human-computer interactions, they could potentially lead to a slowdown in employeeworkflows or trigger customer distrust in artificial intelligence. Ultimately, this could have a significant impact on **production capacity** and **customer experience**.

"*When I ask ChatGPT a question, it might give me a wrong answer. How can I prevent that? For most people, a mistake by ChatGPT just seems like a simple error, but for our lab, it could hurt our reputation.*" The foundational element of artificial intelligence is its reliance on substantial data for learning and prediction. This challenges an organization's foundational digital transformation efforts. Data-driven AI applications are only possible with massive and consistent digital data, supplemented by processing and storage capabilities. *"If the data you want to analyze isn't digitized, if there isn't enough data volume, or even if there isn't sufficient technical capability to apply, then basically, the discussion about artificial intelligence isn't necessary."* Without such data, the expected **data value of AI** may not be achieved, potentially compromising the **credibility and accuracy** of AI tools and algorithms. It's crucial to avoid misplaced trust in erroneous or misguided AI recommendations that could adversely affect an organization's operations and reputation.

Finally, based on the information gathered from the semi-structured interviews, we conducted a qualitative analysis of the three dimensions of corporate readiness and developed a strategic framework for AI adoption (shown in Table 3). This framework clarifies the approach to take once the clear outcomes of AI are evident. It emphasizes the importance of observing external environmental shifts related to the business, verifying the organization's readiness for AI integration, and identifying the essential technical skills to optimize AI's advantages. Furthermore, it highlights the importance of swift adjustment to subsequent sweeping organizational changes.

Table 3: AI Adaptation Strategy Framework.

AI Integration Layers		
Environmental readiness	Organizational Readiness (OR)	Technical Readiness (TR)
1. Focus on market demands and competitive pressures. 2. Competitors' actions serve as the optimal driving force. 3. Incentive policies from government agencies can generate positive feedback.	1. Positive attitude of senior executives. 2. Organization's business and operational models. 3. Resource replanning and utilization.	1. Efficiency and cost-effectiveness. 2. Enhanced customer experience and productivity. 3. Data value breakthrough. 4. Tool reliability and accuracy.

Empirical Validation by Case Enterprise

In the verification case of Company A, the "Red Ink Test" was conducted specifically for business operations that rely most on manual labor, as a pilot for the introduction of AI technology. The Red Ink Test serves as a method for assessing the soldering conditions of electronic components. This is achieved by observing the staining of solder joints to detect their quality, thereby preventing voids or breaks in the soldering process. This current method is time-consuming and heavily dependent on manual observation and intervention. To increase efficiency and determine the benefits of AI integration, Company A utilizes optical microscopy to capture the condition of components. Based on these observations, abnormalities were marked on coordinates (as shown in Figure 2). Furthermore, microscopy images were captured at a 25x magnification to produce a panoramic view, which was subsequently transformed into an Excel presentation. These images are then cropped to augment the dataset, providing sufficient training data for the machine learning model to perform initial binary classification training.
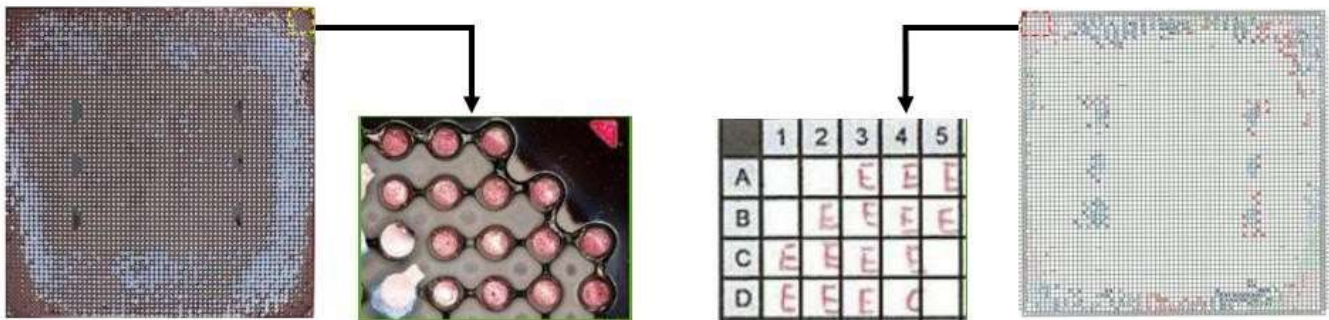

Figure 2 Abnormal mark

Upon completing the data organization of the experimental results stored in the database, Company A created labels for input into the machine learning model for subsequent training. Company A consistently augments its data, which has resulted in successful training outcomes. Company A plans to implement an automated defect identification and entry process in the next phase using the machine learning model. This aims to streamline the Red Ink test workflow to a fully automated process, just one more manual check is required. Our findings indicate that Company A has achieved promising results in introducing AI technology into its business operations and has demonstrated rapid adaptability. They have changed their culture, processes, and adapted to economic, regulatory, and policy changes in the external environment. This success relies on the company's solid foundation in digital transformation. During the digital transformation phase, they actively seek to acquire new technological capabilities. Through the digitization of various business data, operational processes are simplified, and organizational flexibility is enhanced through resource integration, enabling them to dynamically adjust resource scheduling and allocation to predict and improve customer needs. Ultimately, one of the key achievements of digital transformation includes the establishment of a comprehensive digital database containing historical experimental data. In addition, the enterprise's familiarity with AI technology, its understanding of its potential advantages when integrated into business processes, and its diverse skills in processing, scaling, and applying this data, are aligned with our two-stage strategic model built on qualitative analysis resonance. The case also emphasizes that a solid foundation for digital transformation can significantly improve the efficiency and effectiveness of the evaluation, reorganization, and adaptation of AI technology into the enterprise. Consequently, our research ultimately incorporates the two-stage model to propose an overall strategic framework for enterprise-wide transformation (as shown in Figure 3). This strategic framework suggests that companies can initially establish a stable foundation for digital transformation as a preliminary strategy. By gradually digitizing organizational processes, equipment, and technology, they can acquire the ability to adapt to significant changes. Before adopting artificial intelligence technologies, three readiness assessments should be conducted to understand the benefits, requirements, and potential changes that AI technology may bring to the organization. With a solid foundation in digital transformation strategy, the organization's adoption of artificial intelligence technologies in the second phase will be more rigorous, enabling a better insight into potential benefits and risks.

CONCLUSION

Conclusion

This study examines the preparatory measures required for adopting AI technology during the different stages of a firm's digital transformation. It underscores the iterative development enterprises undergo during the transformation process,

emphasizing that a robust digital transformation is the bedrock for the successful deployment of AI technology. By harnessing digital technologies, firms can re-engineer organizational planning and business models, equipping themselves with the prerequisites for AI adoption and fostering a conducive environment for successful AI integration. Senior executives must possess a discerning vision to assess their firm's strengths and weaknesses. Through careful evaluation and analysis, they can identify critical areas for investment and conceptualize how these technologies dovetail with their business models, cultivating new value and competitive advantages. Additionally, these senior executives must exhibit unwavering commitment and a propensity for risk-taking and innovation. While digital transformation and AI adoption might harbor risks and uncertainties, they concurrently usher in unparalleled opportunities. Senior executives should champion innovative thinking, permit experimentation and occasional setbacks, and adjust strategies promptly in response to evolving landscapes.

Limitation

Due to time constraints, this study has limited capacity to examine the integration of AI in a two-stage approach across multiple enterprises progressing in the digital transformation process. It is also noteworthy that while AI rapidly evolves, it has yet to fully mature. As a result, there are only a handful of tools available that can bring about immediate transformational change in enterprises. Most of these tools require a careful, multifaceted assessment of the company. Conducting such an experiment in a more expansive enterprise might necessitate an in-depth review, which could entail several top-tier discussions within the subject company, potentially lengthening the research timeline and affecting the data's reliability. When this topic is discussed further, follow-up data collection on the case study companies is expected to facilitate comparative analysis.

Furthermore, for future research, it's possible to extend the research methodology, such as employing the Fuzzy Set Qualitative Comparative Analysis (FSQCA). In this two-stage and contextually complex study, using FSQCA ensures the inclusion of all relevant factors while also enhancing the robustness of the research framework through the incorporation of quantitative data.
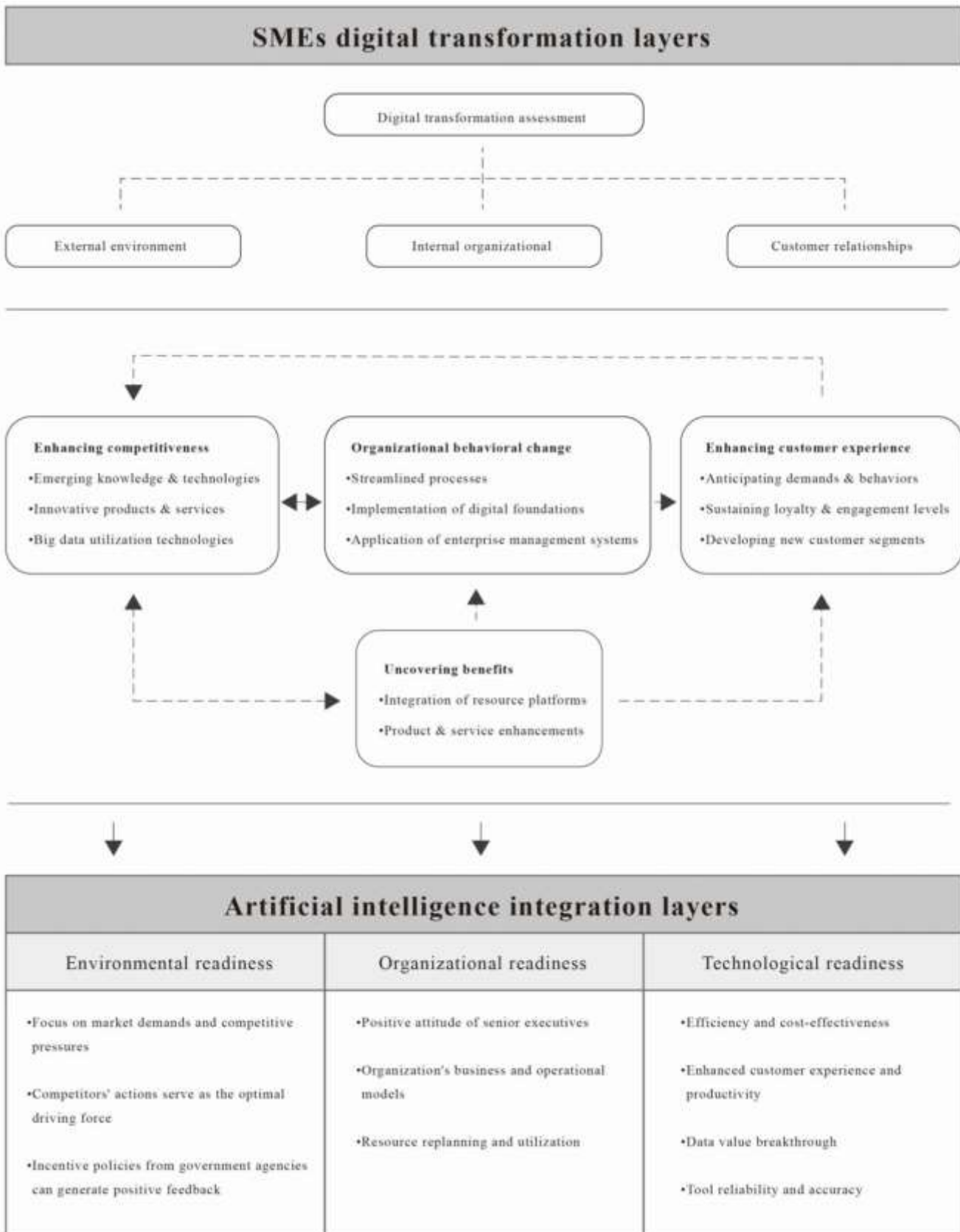
SMEs digital transformation layers

Digital transformation assessment

External environment

Internal organizational

Customer relationships

Enhancing competitiveness
- Emerging knowledge & technologies
- Innovative products & services
- Big data utilization technologies

Organizational behavioral change
- Streamlined processes
- Implementation of digital foundations
- Application of enterprise management systems

Enhancing customer experience
- Anticipating demands & behaviors
- Sustaining loyalty & engagement levels
- Developing new customer segments

Uncovering benefits
- Integration of resource platforms
- Product & service enhancements

Artificial intelligence integration layers

Environmental readiness	Organizational readiness	Technological readiness
• Focus on market demands and competitive pressures	• Positive attitude of senior executives	• Efficiency and cost-effectiveness
• Competitors' actions serve as the optimal driving force	• Organization's business and operational models	• Enhanced customer experience and productivity
• Incentive policies from government agencies can generate positive feedback	• Resource replanning and utilization	• Data value breakthrough
		• Tool reliability and accuracy

Figure3: Digital Transformation Adoption to Adaptation Framework

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