The Role of Dynamic Capabilities and Industry 4.0 in Sustaining ICT Service SMEs in Malaysia: Conceptual Paper

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ABSTRACT

Small and medium-sized enterprises (SMEs) are core to the economic growth of the Malaysian economy, but there is a challenge in maintaining competitiveness in the face of disruptive wave of the Fourth Industrial Revolution (IR4.0). Current studies on IR4.0 adoption have been conducted mostly in the manufacturing industry with little emphasis on the service sector especially information and communication technology (ICT) SMEs. This theoretical paper is based on the dynamic capability theory and suggests a model that places four independent variables (technological capability, innovation culture, organizational readiness, and leadership capability) and organizational sustainability as the independent variable and mediated by IR4.0 adoption. The framework emphasizes the use of digital adoption in converting internal capacity into sustainable performance. The given study is impactful in that it talks about an insufficiently examined context of the service SME, applies dynamic capability theory to IR4.0 adoption research, and provides policy suggestions to enhance SME digital transformation.

Keywords— Dynamic Capability, Industrial Revolution 4.0 Adoption, SMEs service sector, Malaysia

INTRODUCTION

In the metaverse era, the business landscape experienced substantial transformations, credited to a myriad of technological advancements, innovations, and developments (Nambisan et al., 2017). Industry 4.0, often termed the "4th industrial revolution," is recognized as a highly significant topic within contemporary academic and professional spheres. The concept of IR 4.0 involves the synchronization of digital sensors, smart products, and intelligent devices, facilitating coordinated interactions within the ecosystem and reducing the need for extensive human involvement. IR 4.0, illustrated as the fourth industrial revolution in Figure 3, signifies the integration of intelligent technologies such as IoT, big data, cyberphysical systems, additive manufacturing, sensors, artificial intelligence, blockchain, and more (Liao et al., 2017 and Parida et al., 2019).

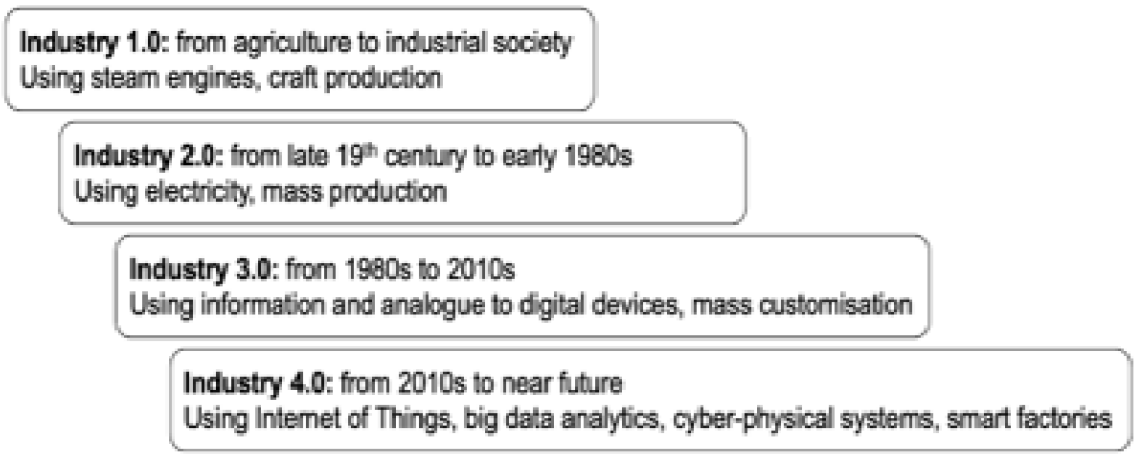

Fig. 1 Evolution of Industry Revolution (IR) 1.0 - 4.0

The evolution of industrial revolutions from Industry 1.0 to Industry 4.0 represents a significant transformation in manufacturing and production processes, driven by technological advancements and changing economic landscapes (see Fig. 1). Each revolution has introduced new technologies and methodologies that have reshaped industries and societies. For the Industry 1.0 has marked the beginning of mechanization, characterized using water and steam power to drive machinery. This period saw the introduction of the steam engine, which revolutionized transportation and manufacturing processes. The mechanization of textile production and the development of iron-making techniques were pivotal during this era, leading to increased productivity and the growth of factories (Mokyr et al., 2015).

Next, Industry 2.0 was defined by the introduction of electricity and mass production techniques. The assembly line, popularized by Henry Ford, allowed for the efficient production of goods at an unprecedented scale. This period also saw the rise of the chemical industry and the use of electric power to enhance manufacturing capabilities, further driving economic growth and urbanization (Mokyr et al., 2015). Later Industry 3.0 introduced automation and computerization into manufacturing processes. The advent of computers and information technology allowed for greater precision and efficiency in production. This era was characterized by using electronics and IT to automate production processes, leading to improved productivity and quality control. The integration of robotics into manufacturing also began during this period, setting the stage for more advanced automation (Madhavan et al., 2022). Latest is Industry 4.0 until now represents the current trend of automation and data exchange in manufacturing technologies. It is characterized by the integration of cyber-physical systems, the Internet of Things (IoT), cloud computing, and cognitive computing. This revolution emphasizes smart manufacturing, where machines and systems communicate with each other to optimize production processes. The focus on big data analytics and artificial intelligence has enabled manufacturers to enhance operational efficiency and responsiveness to market demands (Queiroz et al., 2020 and Dubey et al. 2020).

Small and Medium Enterprises (SMEs) continue to be the pillars in the Malaysian economy, as they occupy more than 97% of business entities and contributing a substantial share to GDP and jobs (SME Corp, 2023). In the service industry, ICT SMEs also contribute significantly to facilitating digital economy of Malaysia using software, e-services and cloud technology solutions. Nevertheless, these companies are forced to work in a fast tech-upheaval, resource-limited, and global market environment, and sustainability is a strategic requirement (Marques et al., 2022). The fourth digital revolution (IR4.0) is becoming an opportunity and challenge to SMEs because it requires agility and flexibility.

Dynamic capabilities that refer to the capability of the firm to sense, seize, and reconfigure resources in line with the evolving contexts (Teece, 2018) are essential ingredients to ensure that SMEs survive in turbulent situations. The existing empirical evidence proves that SMEs that are more dynamic possess greater adaptability and resilience in digital transformation journeys (Ahmad et al., 2021; Jayashree, 2021). Technological capability, innovation culture, organization readiness and leadership capability are the dynamic capabilities in the ICT services domain. These have placed companies in a position to overcome IR4.0 shocks and remain competitive.

Despite policy efforts such as Industry4WRD and NIMP 2030, Malaysian SMEs lag in IR4.0 adoption due to limited readiness, weak infrastructure, and inadequate leadership support (Saleh, 2024; Techanamurthy et al., 2025). In this conceptual paper, it is argued that the drivers of IR4.0 adoption and organizational sustainability are dynamic capability factors as antecedents. Besides, the application of IR4.0 is the mediator that transforms dynamic capability inputs into sustainable results. Therefore, a combination of dynamic capabilities with digital transformation strategies is an indispensable factor to ICT service SMEs in Malaysia.

Problem Statement

SMEs in Malaysia face persistent sustainability challenges due to market volatility, financial limitations, and technology gaps (Shahzad et al., 2023). The ICT service SMEs are well placed to be the forefront in digitalizing as many of them do not have organizational readiness and the commitment to leadership required to incorporate IR4.0 solutions in their business models. This constrains their rivalry and diminishes survival in the long term.

The literature highlights the necessity of dynamic capabilities to facilitate organizational resilience but there is limited literature that combines the concept of dynamic capabilities and factor of IR4.0 adoption to promote sustainability, especially within the context of Malaysian service SME. The literature on the topic usually targeted manufacturing SMEs (Jayashree, 2021; Marques et al., 2022), overlooking the specific solution issues by ICT services, like the rapid software cycles, cybersecurity concerns, and problem-driven innovation requirements.

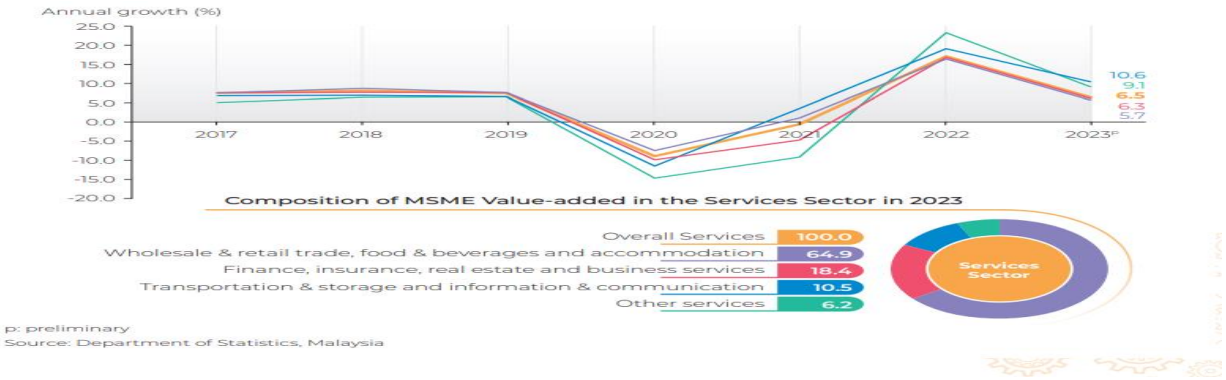

Fig. 2 Value-added Growth of MSME in the Services Sub-sectors (%)

According to SME Corp (2024), MSME Value-added in the Services Sector The positive trend in the services sector continued into 2023 with MSMEs remaining as the main contributor to the MSME GDP overall. Value-added of MSMEs in the sector reported an impressive growth of 6.5% (2022: 17.2%), and the growth was supported by the consumer-related sectors and the transport and storage sub-sectors (see Fig. 2). The sustained recovery of the tourism activities especially as the international boundaries of China reopened mostly helped these industries hence giving more momentum and supporting the overall development of the sector.

Furthermore, in surveying the sub-sector performance, the Wholesale and retail trade, food and beverages and accommodation sub-sector which contributed a major proportion of 64.9% of MSME value-added in the sector improved by 5.7 percent in the year. In the meantime, the transportation and storage and information and communication sub-sector showed even stronger growth, with a remarkable double-digit growth of 10.6% in 2023. The high performance of the given sub-sectors highlights the importance of service-related MSMEs to the overall economic recovery, especially given the growing need of logistics, digital infrastructure and consumer services in a post-pandemic setting.

The difference is further exaggerated in the perception of the mediation mechanism of IR4.0 adoption between the factors of dynamic capabilities and sustainability outcomes. In absence of this interconnection, SMEs will be at risk of undertaking a piecemeal adoption of technology that is not strategically aligned. Thus, the study is critical to explore the impact of technological capability, culture of innovation, organizational preparedness, and leadership ability in the IR4.0 implementation and sustainability of ICT service SMEs in Malaysia.

Research Objectives

The aim of this conceptual paper is to propose and substantiate a framework that connects dynamic capability variables, adoption of IR4.0, and organizational sustainability of ICT service SMEs in Malaysia. The objectives are:

1. To identify the dynamic capability factors towards organizational sustainability in Malaysian ICT service SMEs.

2. To measure the relationship between dynamic capability factors and IR4.0 adoption.

3. To analyze the mediating effect of IR4.0 adoption on the relationship between dynamic capability factors and organizational sustainability.

These aims are put into perspective of the Dynamic Capability View (DCV) and literature regarding digital transformation, which is aligned with the Industry4WRD vision and sustainability agenda in Malaysia.

Significance of Research

The theoretical importance of this study is that the Dynamic Capability View is extended into the IR4.0 adoption background. Although it has been already confirmed that dynamic capabilities are the drivers of innovation and flexibility (Ahmad et al., 2021; Teece, 2018), not many studies have explored the direct correlation between dynamic capabilities and organizational sustainability in the context of ICT service SMEs. This study aids the development of theories in both the strategic management and digital transformation research by placing the adoption of IR4.0 as an intermediary.

The practical importance is that it will inform owners and managers of SMEs in Malaysia on the need to put a priority on building their capabilities towards ensuring sustainability. These insights can be utilized by policymakers including SME Corp and MDEC to develop specific interventions, especially in leadership training, incentives on innovation, and digital preparedness initiatives (Saleh, 2024). The research is also part of the objective of establishing a competitive, resilient, digitally oriented SME sector in Malaysia as part of NIMP 2030.

This paper purposely targets the internal organizational drivers of IR4.0 adoption among Malaysian ICT SMEs: technological capability, innovation culture, organizational readiness and leadership capability. The dimensions are the resources and competencies that SMEs can directly build, manage, and reorganize to stay competitive. Although external influences, including government policies (e.g. Industry4WRD, NIMP 2030), regulatory frameworks and competition in the market are also admittedly significant in the larger adoption environment (MITI, 2023; SME Corp, 2023), they are not directly covered by this conceptual framework. The focus on internal drives allows the study to be consistent with the Dynamic Capability View (Teece, 2018), which focuses on how companies can pull on the strengths and renew the capabilities of the company to respond to technological disruption. However, the empirical expansion of this study in future may include external factors in the form of moderating variables or situational factors to give a more holistic and policy-constrained perspective of IR4.0 adoption in the SMEs.

Lastly, the paper is a conceptual contribution to the policy level in the sense that it identifies the gaps in capabilities that obstruct the ability of SMEs to align themselves with Industry4WRD. The increase in the dynamic capabilities of SMEs will not just increase the sustainability of firms but will also play a part in the digital economy agenda of Malaysia and competitiveness in the long term.

Theoretical Overview

This study is based on the Dynamic Capability View (DCV). According to DCV, firms can maintain the competitive advantage, when they sense opportunity, exploit it and re-align resources (Teece, 2018). Dynamic capabilities applied to the SMEs in terms of technological, innovation culture, organizational readiness, and leadership capability (Jayashree, 2021; Ahmad et al., 2021).

The adoption of IR4.0 is theorized as a facilitator, which is in line with the diffusion of innovation (DOI) and TOE models, which explain that outcomes in terms of adoption rely on the organizational and technological facilitators (Shahzad et al., 2023). The previous literature indicates that dynamic capabilities can help SMEs to address the obstacles to the adoption of IR4.0 and thus convert potential into quantified sustainability results (Techanamurthy et al., 2025).

The concept of organizational sustainability is considered holistically, which implies financial, social, and environmental performance (Marques et al., 2022). This multidimensional approach is consistent with the Triple Bottom Line model, placing greater stress on innovation-driven, digitally enabled, and capability-enhanced paths to resilience in the long-term.

LITERATURE REVIEW

The Role of SMEs and ICT in the Malaysian Service Sector

Most business establishments in Malaysia (over 97% of the total) are Small and Medium Enterprises (SMEs), which play an important role in national GDP and jobs (SME Corp, 2023). Among this ecosystem, service-oriented SMEs have the highest proportion, and it includes sub-sectors like ICT services, professional services, e-commerce, which plays a key role in helping Malaysia transform into a knowledge-based economy (OECD, 2024). The developmental trend of the service sector is also strongly connected with the spread of ICT, where digital tools are becoming the foundation of business models, interaction, and accessibility to the market (DOSM, 2023).

The central enablers of the Malaysian digital transformation are ICT companies in the SME service sector. Such companies do not only use ICT within their organization to automate operations but also offer technology-related services including software creation, cloud computing, and cybersecurity to enable other SMEs to go digital. Such a dual role makes ICT SMEs adopters and providers of Industry 4.0 (IR4.0) technologies, thus increasing their strategic value (Veeraya, Raman, Gopinathan, and Singh, 2024). To realise the industry4WRD and NIMP 2030 goals, SMEs in the ICT service industry should become technological adoption and digital resilience leaders in Malaysia.

Several issues surround ICT SMEs, such as financial constraints, shortage of talent and poor innovation ecosystems, despite their significance. The research emphasizes that organizational preparedness and cultural fit towards digitalization become a challenge among Malaysian service SMEs, which restricts the successful implementation of ICT (Her, Yap, Lee, and Rahman, 2020). All these barriers underscore the role of internal dynamic capability drivers like leadership support, technological capability, and innovation culture as pre-requisites to enable ICT SMEs to attain organizational sustainability.

Organizational Sustainability in ICT Service Sector SMEs

Organizational sustainability has since shifted its traditional financial performance-based understanding to include environmental and social performance, which is typically referred to as the Triple Bottom Line (TBL) (Elkington, 1997; Marques, Ferreira, and Ferreira, 2022). In the case of SMEs, especially in the service industry, sustainability entails remaining competitive and at the same time addressing the expectations of the society and the environment. Considering Malaysia, ICT service SMEs are becoming pivotal drivers of sustainability since they are adopters and providers of digital solutions that facilitate long-term sustainability in the industries (Veeraya, Raman, Gopinathan, & Singh, 2024).

The digital transformation has been the focal point of the studies in recent years which highlighted the concept of sustainability. As an illustration, Jayashree et al. (2021) demonstrated that the stronger the alignment between dynamic capabilities, i.e., managerial commitment and IT infrastructure, with Industry 4.0 initiatives, the better TBL results with SMEs. This is congruent with Franco et al. (2024) who contend that the micro-foundations of sustainability in an unstable environment are the dynamic capabilities, especially the capacity to sense, seize, and in reconfigure, resources. In services concerning ICT, this is expressed in the form of being able to redesign the digital platforms and services offerings according to the needs of the clients without compromising operational efficiency and environmental responsibility.

Digital platforms are becoming more relevant in spurring sustainable service delivery in the Malaysian context. Mohamad et al. (2022) revealed that the digital co-creation platforms in Malaysia did not only support the internationalization of the SMEs but also conveyed practice that upheld organizational sustainability. This implies that ICT service SMEs are in a unique position to capitalise on digital solutions to sustainable growth. In addition, sustainability results are enhanced when companies develop robust information systems to monitor and report on sustainability indicators as noted by Zhao et al. (2021), which underlines the contribution of ICT companies to the development of information-driven sustainability solutions.

Industrial Revolution 4.0 (IR4.0) Adoption in Malaysian SMEs

The fourth industrial revolution (IR4.0) presents artificial intelligence (AI), Internet of Things (IoT), big data, and cloud computing as some of the technologies that can transform the business models in multiple sectors. Nevertheless, uptake among the Malaysian SMEs is unequal. Using both the Diffusion of Innovation (DOI) and Technology-Organization-Environment (TOE) models, Shahzad et al. (2023) identified relative advantage, compatibility, competitive pressure, and top management support as the factors that strongly predict the adoption of IR4.0 in the Malaysian SMEs. Based on their findings, it can be argued that although the awareness of digital technologies rises, its successful implementation is strongly correlated with the organizational preparedness and the determination of the leadership to perform the latter.

The recent evaluation of the IR4.0 preparedness also highlights the weaknesses in the Malaysian SMEs. In a large-scaled survey of 506 SMEs, Techanamurthy, Iqbal, and Abdul Rahim (2025) identified weaknesses in five strategic dimensions which are leadership, governance, digital infrastructure, workforce competency, and strategic alignment. Such gaps can stop the complete integrations of SMEs within the national Industry4WRD framework and the New Industrial Master Plan (NIMP 2030). These results underscore the mismatch between the national policy ambitions and the ground-level capacity of SMEs, and their necessity to be addressed through specific interventions to improve preparedness.

In line with these observations, Saleh (2024) created an IR4.0 preparedness model that suits Malaysian SMEs and that recognizes organization, data, infrastructure, analytics, and IT development processes as the key dimensions of readiness. After analyzing 50 SMEs, the model indicated that the average level of readiness is only 66% implying that SMEs are in the right direction, yet the vast opportunities of capitalizing on IR4.0 technologies have not been realized. In the absence of systematic assistance in infrastructure and workforce reskilling, most of the SMEs will be at risk of shallow adoption that fails to translate into long-term competitiveness.

IR4.0 Adoption in ICT Service Sector SMEs

Industry 4.0 (IR4.0) technologies are frequently described by referring to technology-organization-environment (TOE) and Diffusion of Innovation (DOI) models, which emphasize that readiness, leadership, and environmental pressures are essential factors to consider (Tornatzky and Fleischer, 1990; Rogers, 2003). Shahzad et al. (2023) in Malaysia established that the IR4.0 adoption in the SMEs was greatly predicted by organizational readiness, compatibility, perceived relative advantage, and top management support. It means that the ICT service SMEs not only have to be technologically capable but also must be committed to the idea of leadership and organizational culture.

Nevertheless, there is a significant number of SMEs who are not ready to adopt IR4.0. Techanamurthy, Iqbal, and Abdul Rahim (2025) performed a nationwide assessment of 506 Malaysian SMEs and found significant deficiencies in leadership alignment, governance, digital infrastructure, workforce competency and strategic integration. These weaknesses are the reason why most SMEs, including ICT services, cannot move beyond the digital awareness to efficient adoption. The same results were observed by Wong et al. (2020) who have revealed that the adoption of blockchain by Malaysian SMEs was strictly dependent on the level of managerial support and trust, which are particularly applicable in ICT-service situations where companies must adopt the newest technologies at the organizational level and externally.

The soft factors that are important in the service industry include leadership and culture. Veeraya et al. (2024) demonstrated that the digital culture and digital leadership played a critical role in digital transformation in the digital business among Malaysian service SMEs. This is consistent with Zhang et al. (2022) who opined that the key to the success of digital transformation lies in leadership vision and employee empowerment. In addition, Torrent-Sellens et al. (2023) also demonstrated that the adoption of IR4.0 is the mediating variable between the environmental assets and companies' performance, which proves the idea that adoption is the mechanism that transforms capabilities into sustainability. In the case of ICT service SMEs, this brings out the fact that adoption does not just involve the acquisition of technology, but incorporation of the technology in the practices of the organization to realize long-term performance.

IR4.0 Adoption as Mediator

The concept of IR4.0 adoption is the degree to which companies are adopting digital technologies, including AI, IoT, cloud computing, and big data as part of their operations and service delivery (Vial, 2019). The adoption process is not hasty but relies on the internal capabilities including the leadership, readiness, and innovation culture. IR4.0 uptake in SMEs is usually not implemented in a holistic manner but more incrementally, as a response to resource and expertise limitations (Wong and Kee, 2022).

The mediating role of IR4.0 adoption is confirmed through empirical studies. Jayashree et al. (2021) revealed that the relationship between dynamic capabilities and sustainability outcomes among Malaysian SMEs is mediated by adoption. A similar correlation was also supported by Yavuz et al. (2023), who demonstrated that sustainable performance at SMEs is greatly promoted when the use of IR4.0 is incorporated into the routine operations. The adoption in ICT SMEs can be cloud-based service automation, AI-based personalization, or IoT-based monitoring that improve customer satisfaction and competitiveness directly.

In Malaysia, the adoption is low, and most SMEs use cost, lack of digital talent, and lack of ROI justification as reasons (Techanamurthy et al., 2025). Interventions like the Industry4WRD Intervention Fund by the government assist in providing financial aid, yet internal capabilities are needed to encourage its adoption. It is here that the significance of seeing adoption as the mediator between capabilities and sustainability outcomes lies.

Dynamic Capabilities in SMEs

Initially described by Teece, Pisano and Shuen (1997), dynamic capability theory (DCT) focuses on the capacity of a firm to include, create, and reorganize internal and external resources to respond to the emerging environments that change quickly. In the case of SMEs particularly in service industries, dynamic capabilities do not only prove to be beneficial but can also be viewed as a survival and sustainable growth factor in unstable markets. According to Ahmad, Ng, Kamal Basha, and Abdul Aziz (2021), dynamic capabilities in the SMEs directly lead to the improvement in the performance outcomes since it aids in the service innovation and improves the capability of adapting to institutional changes. The result highlights the need to create adaptive competencies in SMEs, especially in the developing economies like Malaysia.

The SME service industry, which is a major contributor of the GDP and employment of Malaysia, is experiencing challenges such as a scarcity of resources, unpredictable environmental trends and institutional demands. Such companies are usually not financially endowed and do not have access to talented labour and are susceptible to shocks. Dynamic capabilities thus become higher order processes that allow SMEs to effectively use the limited resources strategically. As Jayashree (2021) points out, the commitment of the top management and organizational culture, in combination with dynamic ability, are essential in allowing service innovation and service resilience under the disruption of the digital era.

In addition, the dynamic capabilities in SMEs are not limited to intra-organizational processes but include network and ecosystem integration. Increasing the involvement of Malaysian service SMEs in the globalized digital markets, their ability to detect market shifts, tap into technological opportunities and redesign operational models makes the difference between their survival and extinction. This three-tier operation not only makes them competitive but also places the SMEs in a position to reap long-term benefits of sustainability (Jayashree, 2021). Dynamic capability therefore is not just a hypothetical construct but a reality that SMEs in the Malaysian service environment need.

Dynamic Capabilities Enabling IR4.0 Adoption in ICT Service Sector SMEs

The Dynamic Capability View (DCV) is a solid conceptual framework to gain insights into the use and utilization of IR4.0 technologies by SMEs. Teece (2018) conceptualized dynamic capabilities as the capacity of the firm to perceive opportunities, exploit them with the help of marshaling resources, and reorganizing the assets in order to remain competitive. The Jayashree et al. (2021) study in Malaysian SME realm verified that the commitment of the top management, the IT infrastructure, and organizational integration are paramount

dynamic capabilities in the implementation of Industry 4.0 and the ensuing sustainability results. This gives a solid rationale to examine the factors of dynamic capability in ICT service companies.

ICT service SMEs are especially applicable in four dimensions of dynamic capability, which are technological capability, cultural innovation, readiness of the organization, and leadership capability. According to Lepore et al. (2023), inbound open innovation in building technological capabilities facilitates the adoption of Industry 4.0, which is essential to ICT companies that often involve third-party digital platforms and cloud services. The culture of innovation is also an important factor, which Marques et al. (2022) established as SMEs with robust innovation cultures were more capable of adaptation to the technological change and maintain a competitive role. The culture of innovation in ICT services is associated with agile development practices, cooperative problem-solving, and the willingness to be innovated by the clients.

Another factor that is critical is leadership ability. Ahmad et al. (2021) proved that the support of top-management had a direct impact on the usage and further expansion of the digital technologies among SMEs. In a similar way, Hidayat-ur-Rehman et al. (2023) discovered that transformational leadership aided sustainability performance by adopting fintechs, implying that the ICT service contexts are similar. Organizational preparedness supplements these capabilities with the guarantee of the required governance frameworks, infrastructure, and expertise at its disposal to support adoption (Techanamurthy et al., 2025). Taken together, these results demonstrate that dynamic capabilities do not only enable the adoption of IR4.0 but also the degree of how the adoption leads to sustainability outcomes in ICT service SMEs. Table II below shows previous studies that related to the dynamic capabilities in SME for various sectors in Malaysia.

TABLE II PREVIOUS STUDIES

Author(s) & Year	**Context**	**Method**	**Key Findings**
Ahmad et al. (2021)	Malaysian service SMEs	Survey (quantitative, PLS-SEM)	Demonstrated that dynamic capabilities (leadership, innovation culture) have a direct positive impact on SME performance.
Jayashree (2021)	Malaysian SMEs (various sectors)	Empirical survey	Determined that dynamic capabilities have a high impact on IR4.0 adoption and long-term results (Triple Bottom Line outcomes).
Shahzad et al. (2023)	Malaysian SMEs	Large-scale survey (506 SMEs)	Reported preparedness, management, and outside pressure as major predictors of IR4.0 adoption.
Yavuz et al. (2023)	SMEs in emerging economies	Empirical survey	Discovered that IR4.0 implementation is an intermediate between dynamic capabilities and sustainability results.
Veeraya et al. (2024)	Malaysian service SMEs	Case-based and survey evidence	Pointed out that digital culture and digital leadership are essential to digital transformation.
Bag et al. (2021)	SMEs in developing countries	Mixed-method (survey + interviews)	Proved that adoption of IR4.0 improves sustainable business performance when coupled with dynamic capabilities.

Conceptual Model Development

This research builds a conceptual model incorporating the dynamic capability theory (DCT) and the mediating influence of Industry 4.0 adoption to define organizational sustainability among Malaysian ICT service SME. The framework identifies four independent variables, such as technological capability, innovation culture,

organizational readiness, and leadership capability, as the core dynamic capabilities that have a direct and indirect effect on sustainability via IR4.0 adoption.

Based on the literature, this paper proposes the following model:

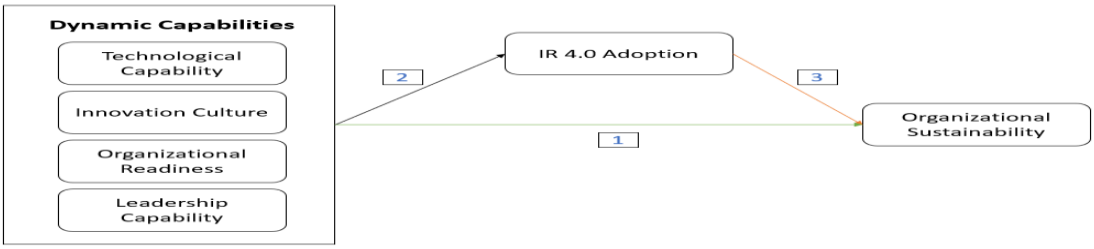

Fig. 3 Conceptual Framework; Source: adapted from Shahzad et al. (2023) and Ahmad et al. (2021)

According to the dynamic capability theory, internal resources need to be felt, captured and reshaped to stay competitive in unstable environments (Teece, 2007). Dynamic capabilities in ICT SMEs manifest in the technological capability, readiness in the organization, vision driven by leadership, and the culture that supports innovation. Nevertheless, these capabilities cannot work alone and need to be converted into action via IR4.0 adoption, which serves as a mediating mechanism (Jayashree et al., 2021; Yavuz et al., 2023). The hypotheses development from the framework as shown in table below.

TABLE I HYPOTHESES DEVELOPMENT

Code	Hypothesis
H1	Dynamic Capabilities positively influence organizational sustainability in ICT service SMEs.
H2a	Technological capability positively influences IR4.0 adoption in ICT service SMEs.
H2b	Innovation culture positively influences IR4.0 adoption in ICT service SMEs.
H2c	Organizational readiness positively influences IR4.0 adoption in ICT service SMEs.
H2d	Leadership capability positively influences IR4.0 adoption in ICT service SMEs.
H3	IR4.0 adoption positively influences organizational sustainability in ICT service SMEs.
H4	IR4.0 adoption mediates the relationship between dynamic capabilities (technological capability, innovation culture, organizational readiness, leadership capability) and organizational sustainability in ICT service SMEs.

CONCLUSION

This concept paper develops an argument which holds that the factors of dynamic capabilities are critical drivers of organizational sustainability in Malaysian ICT service SMEs. Combining DCV and IR4.0 adoption into a framework, the proposed framework outlines the significance of technological capability, innovation culture, organizational readiness, and leadership capability as facilitators of sustainable results. The mediation of the IR4.0 adoption guarantees that the dynamic capabilities are transformed into the concrete gains of resilience, innovation, and competitiveness.

This framework can be the foundation of future empirical research based on quantitative approaches like SEM-PLS, and valuable insights to SME leaders and policymakers to speed up the digital transformation and sustainability agenda in Malaysia. To take up the empirical research, a broader spectrum of the literatures should be consulted to derive a knowledge that is insightful.

This study is conceptual and short-term in design, as the research problem is on developing a theoretical framework, but not empirical measure over time. However, dynamic capabilities do not remain the same over

time; they change in reaction to uncertainty in the environment and disruptive technological changes (Jayashree, 2021; Yavuz et al., 2023). A longitudinal design would then yield more information on how SMEs accumulate, sharpen and restructure their resources with time. This study is not longitudinal, but the framework can be applied in the future with longitudinal surveys, panel data, or case-based tracking of SMEs to explore the development of dynamic capabilities in practice. Although the paper is conceptual, it is hoped that the work would assist in the supplement of literatures to the reference of scholars and play a significant role to the owners and policy makers of the SMEs when the research is complete.

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