[1] Noor Hazlina Ahmad
[2*] Ming Fang Teoh
[3] T. Ramayah
[4] Yuk Fong Chin
[5] Hasliza Abdul-Halim

Digital Technologies as Key Drivers of Business Model Innovation for SME Competitiveness

Abstract: **-** Digital business model innovation (DBMI) is vital in the contemporary digital era. However, there has been a lack of research on DBMI, especially in the context of small and medium-sized enterprises (SMEs). Grounded on upper echelons and dynamic capabilities theories, this study aims to delve into the influence of digital leadership, digital capability, and digital technology on DBMI. By referring to prior literature, theme-based FGD data analysis, and interview findings, the main contribution of present study is to provide insights into how these drivers impact DBMI trajectory. The FGD reveals that digital capability has strong positive integration, while digital leadership and technology have weak positive integration with DBMI. The interview findings highlight the DBMI adopted by four SMEs, their challenges, and digital leadership, digital capability, and digital technology drive DBMI adoption. The findings can facilitate SMEs and policymakers to formulate strategies and policies and make decisions pertaining to DBMI adoption.

Keywords: *Digital Business Model Innovation (DBMI), Digital Leadership, Digital Capability, Digital Technology, Small and Medium-sized Enterprises (SMEs)*

I. INTRODUCTION

Digitalization has had a strong influence to the global marketplace, Rachinger et al. (2019) highlighted that organizations can innovate their business models digitally in order to exploit digital opportunities, produce new products and services at lower production cost, optimize existing production capacity and communicate effectively with stakeholders. In this context, the unprecedented growth and evolution of technology and innovations within the current digital age have been firmly established, with digital transformation trends deeply restructuring the worldwide educational settings, Wong et al. (2024). This ongoing shift highlights the need for organizations to adapt and thrive in an era where technological advancements and evolving markets redefine competitiveness.

In the Malaysian context, SMEs in the service sector and other sectors are organizations with annual sales that not greater than RM20 million or not exceeding 75 full-time employees, while SMEs in the manufacturing sector have sales turnover not greater than RM50 million or not exceeding 200 employees (SME Corporation Malaysia, 2023). As compared to 2021, SMEs' contributions to Malaysia's GDP 2022 recorded a growth of 1.3%, while exports grew at 5.7% (Department of Statistics Malaysia, 2023). SMEs play a vital role in driving the economic growth of Malaysia and are more flexible to make changes to their existing business models.

Innovating a digital business model changes the business structure, processes and value creation for customers and business partners (Martín-Peña, Díaz-Garrido and Sánchez-López, 2018). Digital technologies such as cloud computing, IoT, mobile broadband, and big data analytics can support business expansion and help businesses exploit opportunities in the digital environment (SME Corporation Malaysia, 2018). In the near future, local SMEs in manufacturing and service sectors planning to offer new products and services, improve online marketing, implement new digital business models (SME Corporation Malaysia, 2018). Hence, it is extremely important to determine the drivers of DBMI.

[1] School of Management, Universiti Sains Malaysia

[2*] Corresponding author: School of Management, Universiti Sains Malaysia; Jesselton University College, Malaysia; Twintech International University College of Technology, Malaysia. Email: ming.fang@twintech.edu.my

[3] [1]School of Management, Universiti Sains Malaysia; Daffodil International University, Birulia, Bangladesh; Sunway University Malaysia; Chandigarh University, Punjab, India; Sohar University, Sohar, Oman; The University of Jordan; Universitas Indonesia, Depok City, West Java, Indonesia

[4] Jesselton University College, Malaysia; Twintech International University College of Technology, Malaysia

[5] School of Management, Universiti Sains Malaysia

Copyright © JES 2024 on-line : journal.esrgroups.org

Digital developments have significant impacts on all organizations. In order to survive in the digital age, they need to transform their business models using digital technologies to streamline business operations, improve efficiency and lower average costs (Martín-Peña, Díaz-Garrido and Sánchez-López, 2018; Verhoef and Bijmolt, 2019). Nowadays, customers demand for digital solutions instead of traditional ones on music, travelling and others (Verhoef and Bijmolt, 2019). It is important for organizations to deploy mobile technologies, digital channels and artificial intelligence (AI) to create value, have better connections with customers, and deliver and capture values from them (Verhoef and Bijmolt, 2019; Teoh *et al.*, 2023).

DBMI adoption in Malaysia in its infancy (New Straits Times, 2020), SMEs uncertain on how to adopt DBMI (Sehlin, Truedsson and Cronemyr, 2019). According to chief operating officer of MDEC, Dato Ng Wan Peng, in Malaysia, only 33% out of 98.5% of SMEs use digital technologies in their business activities (Department of Statistics Malaysia, 2020; Menon and Gan, 2020). It shows that the remaining 65.5% of SMEs have not incorporated digital technologies extensively to improve the ways they create and deliver values to customer. They are still using traditional way to manage business activities, resulting in poor organizational performance, which makes it difficult to survive in this digital era.

Even though some local SMEs employ social media platforms for marketing and communication purposes, they are still using traditional payment method such as cash and not integrated online payment gateways, resulting in poor customer experiences (SME Corporation Malaysia and Huawei Technologies (M) Sdn Bhd, 2018). The manufacturing sector in Malaysia has automated fewer than 50% of their business processes (Noordin, 2020). In Malaysia, cloud computing, data analytics and internet of things among SMEs are not widespread or effective (SME Corporation Malaysia and Huawei Technologies (M) Sdn Bhd, 2018).

Digital leadership play a dominant role in driving DBMI adoption. However, effective digital leadership is still lacking in the digital era (Oberer and Erkollar, 2018). Not all leaders are known as digital leaders. De Waal et al., (2016) posit that digital leaders must be able to employ digital infrastructure efficiently to overcome challenges and generate positive outcomes for their organizations.

Digital capability of an organization is an important driver of the adoption of DBMI. Khin & Ho (2019) asserted that SMEs must constantly be ready to employ advanced digital technologies and elevate their digital capabilities. It would be challenging to reconfigure existing digital capabilites (Wulf, Mettler and Brenner, 2017), and so SMEs with extremely low digital capabilities are not able to execute DBMI (Martín-Peña, Díaz-Garrido and Sánchez-López, 2018).

Digital technology can stimulate the adoption of DBMI. There is inadequate literature to examine the impact of digital technology on DBMI (Strutynska *et al.*, 2019). When SMEs are uncertain of technological trends and employ outdated digital technology, this will lead to negative outcomes and the inability to satisfy customer digital needs (Khin and Ho, 2019). In sum, the influences of digital leadership, digital capability, digital technology on DBMI have not been investigated. This study aims to bridge this gap by determining how these drivers affect DBMI in the digital environment. The research question of this study is:

1. How does digital leadership influence digital business model innovation?
2. How does digital capability influence digital business model innovation?
3. How does digital technology influence digital business model innovation?

II. Literature Review

2.1 Digital business model innovation (DBMI)

Digital business model innovation refer an the organization employing digital technology to do remarkable changes on business elements (Veit *et al.*, 2014; Remane *et al.*, 2017). For example, in the smart waste management business, organization employ fill level sensors to organize the routes, emptying schedule, and improve the waste collection process (Aagaard *et al.*, 2018).

To innovate in a digital business model, SMEs need to identify factors that can affect customer behavior, target the right customer segments when offering both digital and non-digital goods, and find potential partners able to provide supporting services (Remane *et al.*, 2017; Woerner, 2019). Collaboration of different parties in supply chain management, innovation activities and the integrated production resources further support the success

implementation of DBMI (Martín-Peña, Díaz-Garrido and Sánchez-López, 2018). SMEs could revise existing offerings, digital capabilities and economic model by adopting DBMI to develop new capabilities and earn higher profit (Bonnet & Westerman, 2015; Parida et al., 2019). This study incorporates four DBMI elements, namely value creation innovation, value proposition innovation, value delivery innovation, and value capture innovation.

2.1.1 Value creation innovation

Value creation innovation of DBMI is the ability of SMEs to use core capabilities, digital technology, partnership, value-added processes to create new value for stakeholders (Still *et al.*, 2017; Clauss *et al.*, 2019; Teoh *et al.*, 2023). Data mining, the internet of things, and cloud computing can be employed in value creation process to achieve internal gains (Frank *et al.*, 2019). More predominately, qualitative research by Clauss et al. (2019) and Still et al. (2017) has found that the changes on value creation innovation such as new capabilities, technology, business processes and partnerships resulting in higher value capture and proposition. Effective value creation processes demand the integration of reliable business partners (Dasí *et al.*, 2017), new physical material, intellectual capital, human and financial resources (Ibarra, Ganzarain and Igartua, 2018). Innovation in value creation processes by a Scandinavian fashion magazine included replacing traditional methods with blogger network to engage fashion bloggers in co-creation process of digital contents, while a Scandinavian newspaper (business daily) used discussion forum and blogs to have two-way open discussion with targeted customers pertaining customer service issues, product development, and digital content production (Wikström and Ellonen, 2012).

2.1.2 Value proposition innovation

Value proposition innovation is related to offering new product/ service portfolio and managing new customer relations with digital technologies (Still *et al.*, 2017; Clauss *et al.*, 2019). In other words, SMEs emphasize products and service offerings, customer needs, and the price they are willing to pay (Dasí *et al.*, 2017). Panda (2019) extended these viewpoint and proposed that value proposition innovation tie with the new offerings and develop good relationships with customers using digital technology. For instance, LinkedIn connects employers and applicants. Employers can post job vacancies and hunt for talent, while applicants can upload their resumes. LinkedIn provides free, limited features to users, and if users require advanced features, they can purchase an exclusive version (Panda, 2019). Amazon uses its cloud computing platform to offer on-demand music and videos, and convenient, fast shipping, and lower prices in a virtual marketplace (Hänninen, Smedlund and Mitronen, 2018). Other studies by Blaschke et al. (2017) and Boojihawon & Ngoasong (2018) assert that digital value propositions focus on on-demand service and personalized product, better understanding of customer preferences thru their purchase history, and proactive strategies. Generally, the value proposition innovation of DBMI relates to customized online services and a variety of offerings that extend the traditional value proposition, which solely stresses product quality, features and price (Slywotzky and Morrison, 2001).

2.1.3 Value delivery innovation

Value delivery innovation refers to using digital technology to have new channel of delivery and market segments, LinkedIn target on mass market and deliver values to the customers via its digital channels, partner channels (Panda, 2019). Value delivery innovation includes targeting new customer segments and developing new distribution channels to deliver value to primary customers and partners (Rayna and Striukova, 2014; Still *et al.*, 2017; Baber, Ojala and Martinez, 2019; Clauss *et al.*, 2019). Value delivery innovation includes flexible ways to improve customer experiences, stimulate customer participation to support SMEs to penetrate international marketplace (Blaschke *et al.*, 2017). Indeed, the value delivery innovation of DBMI elements diverse with conventional business model, Parida et al. (2019) highlighted that this element indicate the most efficient approaches to deliver the expected value globally thru delivery channels, online monitoring systems and excellent customer service. Cloud computing, big data and intelligence sensor can be used to deliver smart products and services to customers (Ibarra, Ganzarain and Igartua, 2018). For example, the new value delivery of Telenor is to deliver e-sims to customers thru retailers and digital channels (Dasí *et al.*, 2017).

2.1.4 Value capture innovation

The value capture innovation of DBMI elements is associated with the ability of SMEs to transform its value proposition into revenues at effective cost by using digital technology (Still *et al.*, 2017; Clauss *et al.*, 2019).

Similarly, Boojihawon and Ngoasong (2018) explained value capture as a model to gain revenues and profits from particular customer segments. In the context of SMEs, value capture innovation refer to cost reduction and exploring the new revenues streams from dynamic pricing and pay-per-use (Ibarra, Ganzarain and Igartua, 2018). In the automotive industry, value capture innovation include investment in digital technologies and improve revenue structure thru digital products/services, whilst media industry is by collecting information on customer buying behaviors, next, using content platform to earn revenues (Rachinger *et al.*, 2018). Digital services decrease the expenses for physical counters and adaptive pricing strategies are able to boost up the revenues (Blaschke *et al.*, 2017). Manufacturer of power system for defense aviation such as Rolls Royce use onboard sensors to practice "pay-per-use" principle as a new revenue model, in which customers (airlines) do not need to buy aircraft engines but only pay for the hourly fee upon using the turbines (Bleicher and Stanley, 2016; International Association of Controllers, 2017). Sensors are able to record hourly usage and customers can make payments accordingly (Bleicher and Stanley, 2016; International Association of Controllers, 2017).

2.2 Digital leadership

Drawing on the Upper Echelons theory developed by Hambrick & Mason (1984), leader with certain characteristic, capabilities and experiences in digital era able to identify external opportunities, threats, foresee future prospects, and these will definitely influence their organizational decisions. Therefore, digital leadership is an important driver to drive DBMI in an organization (Herman and Smith, 2015; Hambrick, 2016; Wasono and Furinto, 2018; Leonardus W.W. Mihardjo *et al.*, 2019).

Gurkan et al. (2019) asserted that digital leadership is acknowledged as leadership 4.0 (leadership in Industry 4.0). Digital leadership is known as subset of IT roles with disruptive innovation. The ordinary terms that are applied widely are e-leadership, business information management and information technology (IT) governance (De Waal, Van Outvorst and Ravesteyn, 2016). Examples of digital leaders include the chief information officer, chief marketing officer, and chief digital officer (De Waal, Van Outvorst and Ravesteyn, 2016; Gurkan, Ciftci and Ozyurt, 2019).

Digital leadership refers to the capability of a digital leader to explore new digital opportunities and disrupt current business models using digital technology and other resources (De Waal, Van Outvorst and Ravesteyn, 2016). Strong digital leadership is vital to drive innovation in business models, especially in terms of innovation on product and services in digital marketplace (Kreutzer, Neugebauer and Pattloch, 2018; Leonardus W.W. Mihardjo *et al.*, 2019).

Digital leadership plays an important role in the digital disruptive environment. Digital leaders can develop DBMI, penetrate new market segments and coordinate digital transformation activities in their organization (Wasono and Furinto, 2018). Digital leaders use digital technology to collaborate with stakeholders in value creation innovation activities, subsequently supporting digital business model innovation (Mihardjo and Sasmoko, 2019).

Data-driven leaders tend to make decisions and formulate new strategies using data analytics and microsystems technology (Liu, Chin and Ma, 2024). However, not all leaders are eligible to be known as digital leaders. According to Gurkan et al., (2019), digital leaders must be able to use digital resources to facilitate DBMI, optimize business efficiency and growth, and at the same time, stimulate employees to become autonomous, develop unique ideas and active participation in brainstorming session. Competencies of a digital leader include ability to manage digital technology for strategic advantage, governing risk and making digital technology related decisions, employ digital technology to create value and leverage organizational performance (Valentine and Stewart, 2015; De Waal, Van Outvorst and Ravesteyn, 2016). In the context of the telecommunications industry in Indonesia, digital leadership can influence business model innovation directly (Leonardus W.W. Mihardjo *et al.*, 2019). They explain that creative digital leaders with global mindset and risk-taking can provide direction and foster innovation activities, carry out organizational change and new ways of doing business in the digital age.

Ultimately, Oberer and Erkollar (2018) have posited that this leadership style is greatly emphasizing on innovation, team performance, cross-hierarchical and cooperative-oriented. Digital leaders have high proficiency in technology and concern on employee needs, they use digital resources efficiently, agile and actively embrace changes to adapt to the rapidly changing environment, solve complicated problems with distinctive solutions, delegate task according to employee competencies, and create a flexible workplace and cooperative atmosphere.

According to El Sawy et al. (2016), digital leadership is able to think differently on business models and strategy, integration of the enterprise platforms, mindsets and digital skill, organization's IT function, and organize flexible working environment. It is postulated that digital leaders can lead employees to adopt DBMI and perform better than competitors.

2.3 Digital Capability

Digital capabilities refer to the ability of SMEs to manage digital technologies (Khin and Ho, 2019). Technological capability as an organizational factor (Del Aguila-Obra and Padilla-Meléndez, 2006) is associated with the organization's ability to employ different types of technologies (Afuah, 2002; Zhou and Wu, 2010). Zhou & Wu (2010) posit that technological capability has direct impact on innovation activities. Khin & Ho (2019) found that organization's digital capability can be improved by digital professionals who employ digital technologies to create new digital products to satisfy the new needs of customers.

By referring to the dynamic capabilities theory, digital capability is part of the dynamic capability of SMEs, who can reconfigure its digital capability to launch new offerings and expedite existing business processes (Khin & Ho, 2019; Teece & Pisano, 1994). To stay competitive, organizations must generate new digital capabilities and leverage existing digital resources to support the adoption of DBMI (Carcary, Doherty and Conway, 2016; Wiesböck, 2019).

There are some barriers to manage digital capabilities, such as identifying the methods to transform and evolve current capabilities. These cannot be overcome if SMEs lack digital talents, digital resources and flexibility (Wulf, Mettler and Brenner, 2017). Digital capability of hospitals are crucial in managing, transferring and accessing the clinical information, assist clinical related decision making and optimize operational efficiency (Wetering, Versendaal and Walraven, 2018). In fact, internet organizations (known as digital natives) have higher digital capabilities to execute digital activities and innovate digital business model than other organizations (Vendrell-Herrero *et al.*, 2018). SMEs with deficient digital capabilities are not able to develop DBMI (Martín-Peña, Díaz-Garrido and Sánchez-López, 2018). Nonetheless, non-digital SMEs can adopt DBMI via integration or acquisition of digital native SMEs in order to share their digital capabilities (Vendrell-Herrero *et al.*, 2018). Effective digital capability leads to efficient business operations, better customer experiences and an agile business model (Westerman, Bonnet and McAfee, 2012). This hints that digital assets can support implementation of DBMI (Bonnet and Westerman, 2015). SMEs with high digital capability, coupled with competitive business strategy, have a high revenue model (Bughin and Zeebroeck, 2017).

Information technology (IT) capabilities have a direct relationship with digital business value (Riera and Iijima, 2019). On the other hand, Chae et al., (2018) found that when the role of IT is to "transform" to the new ways of doing business in airline, accounting, publishing, telecommunication industries, organization with superior IT capability did not achieve better performance than other organization with similar size. Conversely, when IT capability is used to promote "automation" in metals, utilities and transportation industries, organizations with higher IT capabilities have the same performance as organizations of same business size (Chae, Koh and Park, 2018). It justified that not every industries must possesses high IT capability to improve its value capture (Chae, Koh and Park, 2018). Digital capability could be playing a more influential role than IT capability to influence the adoption of DBMI in order to achieve better performance in digital era.

Digital capabilities, which include information management capability and adaptable IT infrastructure, are essential in digital era as it allow organization to promptly response to the customers' new digital requirements (Levallet and Chan, 2018). They revealed that new IT infrastructure at affordable cost can be acquired by digital enterprise and small businesses, another essential point is regular assessment on organizations' digital capability are required, frequency to conduct this assessment depends on business size and the extent of macroeconomic changes. Digital capability can improve value creation, value delivery (Grover and Kohli, 2012) and value co-creation activities with customers (Lenka, Parida and Wincent, 2017). Preliminary findings from Da Silva Freitas et al. (2017) claim that responsive and agile digital capabilities are the driver of a digital business model. It reflected that the greater digital capability of SMEs, they have greater capability to execute DBMI.

2.4 Digital technology

Digital technology such as mobile devices, analytics, social media, enterprise software can expedite operational processes, new approach to manage business activities, support effective communication with partners and customers, amplify customer experiences, and make pervasive changes in a business model (Fitzgerald *et al.*, 2013; Li, 2018).

Based on the dynamic capabilities theory, digital technology is the important asset for SMEs to constantly reorganize its business model and adopt DBMI to achieve long term success (Khin & Ho, 2019; Miles, 2012; Teece, 2018). SMEs should embrace digital technology at optimum level, for instance big data, cloud computing, artificial intelligence, cyber-physical systems, internet of things, augmented and virtual reality (Urbinati *et al.*, 2018; Khin and Ho, 2019). Digital technology supports an organization in targeting new market segments and build closer relationship with customer at lower costs, customers can personalize products based on their preferences and make payments according to the exclusivity level of the products (Li, 2018).

SMEs with digital mindset are responsive to technological changes and harness new digital technology to adopt DBMI, recognizing digital technology as a strong tool to accelerate innovation activities and provide distinctive digital offerings (Khin and Ho, 2019). For example, in the SMEs manufacturing context, collaborative robots (cobots) can work together with human to enhance SMEs productivity, reduce defect rates, implement value creation innovation and increase profits (Noordin, 2020).

Artificial intelligence (AI) technology has been applied extensively by many organizations. For example, Amazon Alexa communicates with humans virtually, and allows autonomous cars to identify obstacles and respond accordingly (Zaki, 2019). CEMEX Go is a digital system to deliver ready-mix concrete products to customers after they place orders; Emirates Airline has adopted both real-time analytics and AI to disrupt its business model and diminish aircraft turnaround at Dubai International (DXB) airport (Zaki, 2019). These demonstrate that digital technology can impact DBMI components in order to deliver seamless services and delightful customer experiences.

Digital technology impacts business operations, costs and revenue, support business expansion at the global stage (Leonardus W.Wasono Mihardjo *et al.*, 2019). Lack of awareness of technological trends and employ inappropriate digital technology leads to poor performance and inability to offer innovative solution to fulfill customers' digital needs (Khin and Ho, 2019). Digital technology add value to the main services offered by an organization. Mobile apps can be used to check different coatings and painting processes at an oil painting exhibition (Li, 2018). Fashion retailers can employ the webcam social shopper tool developed by Zugara, which is a virtual fitting room that allows customers to virtually preview their appearance with the chosen clothes (Batista, 2013). 3D printers can be used to produce customized fashion items like jewelry and accessories ordered by customers, finally, an interactive mirror can be integrated with inventory and the internet to capture a customer's image and merge it with clothes (Batista, 2013).

Digital technology has a significant influence on DBMI dimensions such as value proposition innovation, value creation innovation, value delivery innovation, and value capture innovation in digital platform oriented businesses, automotive and creative industries (Hildebrandt *et al.*, 2015; Li, 2018; Bouncken, Kraus and Roig-Tierno, 2019). Strutynska et al. (2019) stated that social media, supply chain management (SCM), enterprise resource planning (ERP), telematics, supervisory control and data acquisition (SCADA) business process management (BPM), cloud computing, and data mining can be used in value creation innovation. To improve value proposition, organization can employ digital system like product lifecycle management (PLM), product data management (PDM), digital sensors, chat bot, customer relationship management (CRM) (Strutynska *et al.*, 2019). Google Analytics, avatar digital persona, the internet, email, mobile devices, and e-commerce platforms can be adopted to transform value delivery (Strutynska *et al.*, 2019). Meanwhile, cost and revenue models can be magnified by using forecasting analytics system, stastistical system and analysis of big data (Strutynska *et al.*, 2019). To sum up, digital technology is an enabler of DBMI and can support SMEs' efforts to offer idiosyncratic digital solutions.

III. METHODOLOGY

Cross-theme analysis, theme-based FGD data analysis, and interviews were performed to investigate the factors contributing to DBMI among Malaysian SMEs.

3.1 Cross-theme analysis

To conduct a cross-theme analysis based on the philosophical paradigms, researchers have taken a slight dig on the qualitative approach. Among the categorized philosophical paradigms, the most significant are ontology, epistemology, axiology, rhetorical structure, and methodology with research paradigms of positivism, post-positivism, constructivism, inter-pretivism, and the critical-ideological perspective (Andalib, 2018; Creswell, 2013). According to Andalib and Darun (2018), the parameters, found from qualitative coding and developed into themes, are the final stage of cross-checking and relativity analysis with the philosophical paradigms.

Table 1 reveals the LR articles and their directed codes as per qual research. Table 2 discusses the cross-themes analysis based on the philosophical paradigms.

Table 1: LR articles coding

LR Scholars' Articles	**Raw Codes for Qual Research in NVIVO**
Pucihar et al. (2019)	Value orientation of Business Model, motivational factors, performance factors
Teece (2018)	Value creation in Business Model, technological linkages
Dasí et al. (2017)	Value proposition in Business Model, cost orientation, innovative modules
Boojihawon & Ngoasong (2018)	Organization strategy, Business Structure and Practices, Profitable Model
Remane et al. (2017) Veit et al. (2014)	Smart waste management business,
Aagaard et al. (2018)	Emptying schedule, improve waste collection process, routes, digital business model innovation
Martín-Peña et al. (2018)	Implementation of DBMI, integrated production resources
Bonnet & Westerman (2015)	Innovative and customized insurance package via mobile app, new capabilities
Clauss et al. (2019)	SMEs core capabilities, digital technology, partnership, value-added processes
Still et al. (2017)	Data mining, internet of things, cloud computing
Frank et al. (2019)	Partnerships resulting in higher value capture and proposition.
Ibarra et al. (2018)	New physical material, intellectual capital, human and finance resources
Wikström & Ellonen (2012)	Customer service issues, product development, and digital content production
Panda (2019)	Talent hunt, talent management, advanced features for customers
Hänninen et al. (2018)	Highly stress on convenient, fast shipping, lower price at virtual marketplace
Slywotzky & Morrison (2001)	Value proposition of DBMI, customize online services, variety offering that have been extended the traditional value proposition, product quality, features and price
Blaschke et al. (2017)	Highly stress on convenient, fast shipping, lower price at virtual marketplace
Rayna & Striukova (2014)	Distribution channels, most efficient approaches
Hambrick & Mason (1984)	Leader with certain characteristic, capabilities and experiences in digital era
Herman & Smith (2015)	Leadership, digital obstructions
Wasono & Furinto (2018)	Organizational decisions, external opportunities, threats,

Gurkan et al. (2019)	Assert that digital leadership is acknowledged as leadership 4.0 (leadership in Industry 4.0).
De Waal et al(2016)	Is e-leadership, business information management or information technology (IT) governance
Gurkan et al. (2019)	Digital leaders such as chief information officer, chief marketing officer, chief digital officer
Kreutzer et al. (2018)	Business model, especially innovation on product and services in digital marketplace, digital SMEs
Leonardus W.W. Mihardjo et al. (2019)	Digital leadership. digital age, risk-taking, global mindset
Oberer and Erkollar (2018)	Leadership style, innovation, team performance,
El Sawy et al. (2016)	IT functions, integration of digital enterprises, flexible workplaces, distinctive solutions
Khin & Ho (2019)	Constant reorganizations of SMEs' business model, adoption of DBMI
Afuah (2002)	Technological capabilities
Zhou & Wu (2010)	Various technological factors, innovation activities
Miles (2012)	Digital capabilities, innovation, organizational factors
Carcary et al. (2016) Wiesböck (2019)	Adoption of DBMI
Wulf et al. (2017)	Lack of digital talents, digital resources and flexibility
Wetering et al. (2018)	Decision making and optimize operational
Westerman et al. (2012)	Effective digital capability leads to efficient business operations, better customer experiences and agile business model
Vendrell-Herrero et al. (2018)	Internet organization, higher digital capabilities to execute digital activities and innovate digital business model than other organization
Bughin & Zeebroeck (2017)	SMEs with high digital capability, coupled with competitive business strategy leads to high revenue model
Riera & Iijima (2019)	Information technology (IT) capabilities has direct relationship with digital business value
(Chae, Koh and Park, 2018)	Value capture
Levallet & Chan (2018)	Customers' new digital requirements, adaptable IT infrastructure
Grover & Kohli (2012)	Micro-economic changes, affordable cost, improvement in value creation
Lenka et al. (2017)	Value co-creation activities with customers
Fitzgerald et al. (2013) Li (2018)	Analytics, social media, enterprise software can expedite operational processes, new approach to manage business activities, support effective communication with partners and customers, amplify customer experiences, and make pervasive changes on business model
Urbinati et al. (2018)	Optimum level, for instance big data, cloud computing, artificial intelligence, cyber-physical systems, internet of things, augmented and virtual reality

Noordin (2020)	SMEs manufacturing context, collaborative robots (cobots) can work together with human to enhance SMEs productivity
Zaki (2019)	Digital system to deliver ready-mix, seamless services
Batista (2013)	Interactive mirror, integrated data inventory and internet, capture customer image
Strutynska et al. (2019)	Forecasting analytics system, stastistical system, analysis of big data
Creswell (2013)	Innovation base, vision base, cost base, strategy base
Andalib, Azizan and Abdul-Halim (2020)	Innovation base, skillset base, performance base, motivational activities base
Andalib and Abdul-Halim (2019)	Performance base, motivational activities base
Auerbach and Silversten (2003)	Alignment base, infrastructure base, new technology system and application base, innovation base, cost base, competition with the stakeholders base

The raw codes are generated from the Tool and analyzed based on philosophical paradigms to generate the sub-themes. To elaborate, the raw themes are taken from scholarly articles mentioned in the Table 1. The sub-themes are then grouped based on meaning and application as the final themes for digital business model innovation. The categorization of the raw codes to sub-themes and the sub-themes to final themes are described in Table 2.

Table 2: Cross-Theme Analysis

Themes	**Sub-Themes (digital business model innovation)**	**Philosophical Paradigm**	**Scholars' Ref**
Digital Leadership	Innovation base, vision base, cost base, strategy base	Ontology, Interpretive Post-Positivism	Creswell (2013) Andalib Azizan and Abdul-Halim (2020)
Digital Capability	Innovation base, skillset base, performance base, motivational activities base	Ontology, Constructivism, Rhetorical, Axiology	Creswell (2013) Andalib and Abdul-Halim (2019)
Digital Technology	Alignment base, infrastructure base, new technology system and application base, innovation base, cost base, competition with the stakeholders base	Constructivism, Epistemology and Methodology	Creswell (2013) Auerbach and Silversten (2003)

Convergence of the characterized meaningful themes in the physical business scenario by implementing the virtual philosophical notion always becomes the difficult phase. The rapid infusion of innovative and new technological system, apps, networks need to create the inline adjustment with the existing technological capabilities, business models and designed customized frameworks. Nevertheless, value addition in certain themes typically extends the capabilities in a complex form and provides the opportunity to deal with initiation and revolutionary possibilities (Andalib, 2018).

The three themes are elaborated in the qual-data as driven from end-to-end coding processes, where the raw and flawed codes are transferred to the meaningful furnished themes to assist in building the research model (Andalib and Darun, 2018). According to Andalib and Abdul-Halim (2019), the leadership determinants are generated from

this soft qual technique as well. Nevertheless, in this paper the scholars have validated the digital leadership theme from the interview findings besides justifying it with the FGD data. Also, the qual-FGD data has been thoroughly scrutinized while finalizing the theme digital capability, as the capability of resources is not just machine-oriented, but also human-oriented (Auerbach and Silverstein, 2003; Andalib et. Al, 2019). Twenty participants had a roundtable discussion with the focus on generated themes. In the focused group discussion, the participants discussed various themes and constructs. The themes included 'digital leadership', 'digital capability' and 'digital technology'. Table 3 reveals the FGD data regarding the acknowledged themes.

Table 3: Theme-based FGD data analysis

Themes	FGD participants' focus	Applicability on the model
Digital Leadership	9 +	"weak integration"
Digital Capability	12 +	"strong integration"
Digital Technology	7 +	"weak integration"

3.2 Interview findings

Interviews were conducted to ascertain whether literatures and anecdotal evidences reflect the real-life situation. Semi-structured interviews with four Malaysian SMEs (business owners /directors) that adopted DBMI were conducted at their respective organizations. The interview duration ranged from 60 to 80 minutes. Respondents were asked to provide information related to their perceptions on DBMI, their adopted DBMI, challenges during DBMI adoption and driving factors that stimulate them to adopt DBMI.

a) Digital business model innovation (DBMI)

Two SMEs respondents (namely respondent A, B) from manufacturing industry, they mentioned that DBMI as a new term for them. They perceive it as something that related to digitalization, creativity and new business models.

Respondent A produces baby-related products. The value creation innovation of DBMI includes a business owner who keeps learning new capabilities from YouTube and Google and shares these with employees; discuss with friends and searching from Google to identify new technology/machines that could be incorporated in the business; using reliable system to improve business efficiency, in addition, the business has new partnership with baby shops, suppliers, outsourcers to produce and distribute the products more efficiently. He delineates that other than manufactures their own brand quality baby-related products, they also provide new offerings for every 2 to 4 weeks, such as offer top selling baby accessories (including digital toys) in local/foreign countries, and pioneering baby-related products/packages not yet sold by competitors. Their business usually sells new products and services at a small scale or WhatsApp groups in certain regions to check the market responses. To build new customer relations, the business shares useful and reliable information to gain trust and loyalty from customer, and communicates with them via company website, Facebook and Instagram. For now, the business is targeted to domestic customers, new market segments and product diversification. This involves using online platform to target pet owners by offering pet related products such as safety gates and bedding; and new distribution channels including new sales agents, retailers, and baby fairs. The new sources of revenue are gained from new offerings (including digital accessories), in terms of cost structure, the business always making bulk purchases to reduce cost, arrange transport and delivery to mitigate expenses, increase profit margin.

Respondent B produces chemical-related products. He explained that product training is regularly provided to improve employee competencies, especially for employees involved in production processes and managing digital machines. The business operations are managed by using SQL system, point-of-sale system, cloud computing. He highlighted the new partners/ suppliers from different regions such as Europe and Thailand; efficient processes to import products; mixing ingredients and producing the final products; and digital packaging processes. Value proposition innovation that has been undertaken was using digital technology to offer new products in high quality with proven results and provide warranty to customers. Value delivery innovations of DBMI include using retailer channels, social media, webpage, and exhibitions to deliver products and services; prompt response to customer

problems; and resolving them immediately before the problem gets worse. Their new sources of revenue are mainly from new and diversified products based on current trends and customer-specific requirements.

Another two SME respondents (respondents C and D) from service industry offering professional part-time service and professional IT service respectively, they hold the similar view that DBMI is related to using existing digital infrastructure to manage business activities.

Respondent C emphasized that due to the server support issue in China, the business redesigned its business model and used online platform to offer professional part time services such as copywriter, translator, digital marketing officer, app sales executive, app developer and part time dance teacher. The business targets employers and part timers in Malaysia. Virtual meetings and teleconferences are employed to have better communication with them. Digital technologies such as WordPress, cloud computing (Amazon Web Services), and react native are used to manage business operations, Slack is applied for internal communication purposes. He said that the new partnerships include collaboration with universities, colleges, SMEs, government agencies and outsourcer. Due to the Covid-19 pandemic, the business offered part time services for free until end of December 2020, and afterwards charged certain amounts for unlimited posting on its official webpage. The revenue streams from the value proposition and the cost structure will be examined from time to time to achieve competitive advantage.

Respondent D posits that the value creation innovation includes developing new capabilities of employee via internal training to support DBMI. He keeps track of the latest technologies overseas and local programming systems, incorporating relevant technologies and systems into the business and engaging actively in technology related forum. The business formed new partnerships with Amazon, Alibaba (cloud computing system), relevant suppliers and customers. Efficient development process can support DBMI, by using coding to design the system based on customer demand, testing the final output and perform improvement when needed, combine the relevant systems to develop a complete system and make sure there is no any error, offer professional support and guidance to customer via virtual channels. He highlighted that the business utilizes advanced technologies to offer customized and robust solution to customers at an effective cost. The core offering are website and mobile app development, and cloud and application programming interface (API). The business is targeted on niche market and its unique selling point is capability to design the quality system from scratch until the completed system instead of using default/common template to serve mass market. He mentioned that to stay competitive, the business provides new offering (new features/function add-on, newly integrated system) every 3 to 5 months. For machine learning, the business able to collect the data legally, analyze 1TB data and above (from year to date) in the same industry of local and foreign countries. Other professional IT services such as Internet of Things (IoT), artificial intelligence, online security solutions, enterprise applications and services are offered by the business. He mentioned that their strong technical background, proven track record, capability to use innovative and latest technologies can enhance customer retention and encourage purchases of add-on features. When existing customers were satisfied with the completed system, thru word of mouth, they will recommend the system to their friends / business partners. The business is targeted on niche markets located in Malaysia, China, Singapore and so on. They give commissions for referrals for the successful contract/agreement/business transaction. Revenue streams come from contracts and mutual agreements and new offerings. There are costs incurred due to low efficiency. To address this issue, he will evaluate which process /part take more time and try to reduce this time immediately.

b) Challenges during DBMI adoption

Respondent A explained that: “At the initial stage to adopt DBMI, it takes time to supervise and require employees trying their best to avoid making the same mistake such as key in the wrong code/ quantity and forget to fill in the required information, I have been give internal training to all employees pertaining new steps and procedures to use new systems, performance-based rewards was offered to encourage employees to improve the productivity”.

Respondent B mentioned that he has to spend more time to attend relevant workshops and provide training to employees, as not all employees are committed towards DBMI adoption. Some employees were reluctant to learn new processes. To resolve this problem, himself and other directors communicate the benefits of DBMI adoption, show the possible outcome and actual performance after DBMI adoption to let employees know there is an urgency to change the business model, and guarantees that when the business achieve higher performance, employees can receive higher bonus than previous year.

Respondent C highlighted that as a newly established business in the past few years, it was challenging to persuade employers and government agencies to collaborate with them and support its DBMI, because these parties are looking for strong portfolio that they are lacking.

Respondent D posited that due to rapid technological changes, speed is extremely vital for his business. He must always ensure that he and all employees practice good time management and are able to accomplish the quality output within predetermined deadline. He said that there are four stages in the process development of new system, which are designing the required components; using coding to build the system; integrating the required systems without any error; and providing technical support to global customers. Each stage must be accomplished within 1 to 2 months. Additionally, due to his high expectations for employees, it would be challenging to recruit new employee with the required qualifications, particularly those can master advanced digital technologies and can perform the task with high productivity.

c) Factors influencing DBMI adoption

Respondent A mentioned that: "I can be considered as a digital leader, having the digital skills, visionary, creative, practice delegation, implement organizational changes, create flexible and cooperative workplace in the digital environment". The future direction of the business is targeted on global markets and establish new physical retail baby shops, to improve creativity, he always reading books, analyze how overseas doing business, check competitors' products and services, strategies. He delegates authority to employees, and encourages them to work autonomously and shares their thoughts anytime. To manage risks, for any new products/design from a new supplier, the business will request for sample, do testing first by buying low quantity, check for the reviews (if the reviews are available). Other than offering new products and services, the business plan to use YouTube, blog to share information on how to use /install certain products, indicate the benefits of the products, find influencer in baby industry such as famous mother to promote or guide customer on product knowledge. Respondent B and C acknowledge themselves as digital leaders who are always looking for unique ideas, providing future direction for the business, exploring new opportunities and developing blue ocean strategies. Respondent D emphasizes that the business's vision is "Using global top 500 technologies as common technologies to serve local and global customers". For now, the business is able to offer a system which is similar to both an enterprise resource planning (ERP) system and artificial intelligence (AI) system at competitive and lower price. During Covid-19 pandemic, the business support the small businesses doing "Live" using auction, bidding, attractive features at an effective cost. He said, "The creativity of the digital leader can be reflected thru process innovation and beware of the potential risks".

Respondents A, B, C, D said that to support DBMI, their businesses have digital capability. Respondent A and B explain that they will check the new digital technology/system that could be employed by the business annually, assess the cost to acquire it, the possible outcome and efficiency, the suitability and whether the technology/system is user-friendly or not. Respondent C has outsourced the system employed by the business, and the outsourcer will update the latest features. Respondent D has high awareness of the new technology, he usually obtains the latest update from social media, subscribed relevant groups and YouTube channels.

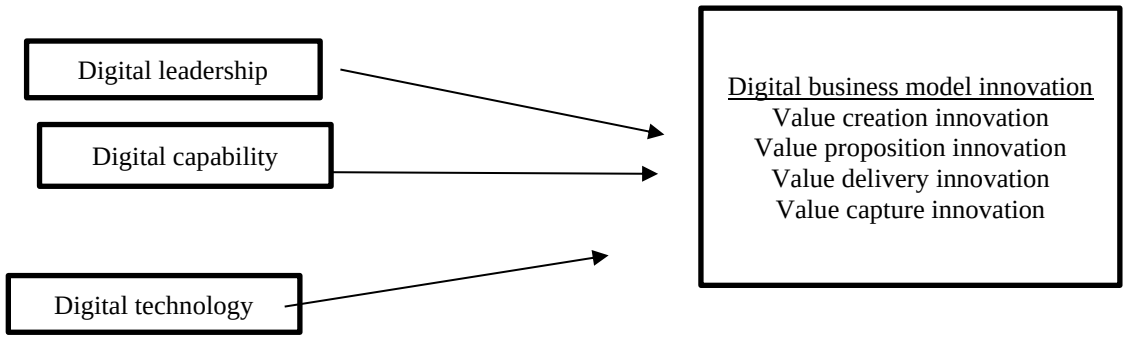
Respondent A mentioned that digital technologies at affordable price, effective cost and user-friendly play a dominant role in DBMI adoption. Respondent B delineates digital technologies leads to new approaches to perform the tasks, create and deliver values to customers, provide accurate data that aid in forecasting the production output and sales, improve the production processes and raise productivity. For respondents C and D, from their experiences, knowledge gained from Google and YouTube, they can determine the most appropriate digital technologies to support DBMI.

Ultimately, the findings from interview support the findings of prior studies, they emphasize that DBMI is considered a new phenomenon among Malaysian SMEs, and DBMI can be influenced by digital leadership, digital capability and digital technology.

IV. PROPOSED RESEARCH MODEL

Based on prior work, cross-theme analysis and interview findings, this study proposes a research model (Figure 1) that illustrates the influence of digital leadership, digital capability, digital technology on DBMI.

Figure 1: Proposed research model



V. Discussion and Conclusion

Digital business model innovation (DBMI) is a powerful guideline and navigational tool to guide the business direction and promote competitive advantage over competing organizations. However, it is still considered a new phenomenon among Malaysian SMEs. Factors associated to DBMI adoption have been proposed in the present study. Interview findings delineate that digital leadership, digital capability, digital technology are the driving forces for DBMI adoption. These findings are consistent with the findings by Bouncken et al. (2019), Carcary et al. (2016), De Waal et al. (2016), Li (2018) Wasono & Furinto (2018) and Wiesböck (2019).

Digital leaders that familiar with the advanced digital technology able to incorporate the distinctive functions of digital technology to innovate the existing business model. Digital leader who is open-minded, willing to accept new thoughts and ideas, always striving for excellent performance, challenge existing ways to do business, able to foresee future digital opportunities is the driving factor for the adoption of DBMI. When digital leader believe the employees are competent and able to work independently without frequent supervision, create flexible working environment and inspire employee to think differently, creative ideas that carry reasonable risks, this can be resulting on the culture that employee always ready and competent to accept changes in the organization, hence the DBMI adoption can be carried out successfully.

SMEs' digital capability can be reflected in its capability to use and keep updated on the advanced technology, acquire new digital technology to produce products and services at feasible cost, this resulting in DBMI adoption process became more steady and smooth. To stay competitive in the long term, SMEs should benchmark the industry leader and recognize what are the most critical and competitive digital resources that were deploy by them to execute DBMI adoption, next, equip the business with the require digital resources to face future digital challenges in the industries. It is vital for SMEs to review the digital capability constantly, improve it when necessary to ensure the organization's digital capability is compatible with the dynamic business environment to develop unique DBMI to raise its competitiveness.

Rapid advancement in digital technology leads to dramatic shift among SMEs, it motivates them to adopt DBMI, automate and digitalized business processes in digital landscape. Digital technology can be employ to expedite and simplify business processes, communicate and deliver values efficiently to the stakeholders, develop new digital products and services, target on selected customers by using the features that offered by FB page and google ads, create new revenue model via cross-selling that generated by the system, and the high efficiency attained can diminish the operation costs. These implies that digital technologies can promote the value creation innovation, value proposition innovation, value delivery innovation and value capture innovation.

The FDG data obtained from 20 participants shows that digital capability has strong positive integration with DBMI, this is in line with the interview findings and the study conducted by prior researchers (Carcary, Doherty and Conway, 2016; Vendrell-Herrero *et al.*, 2018; Wiesböck, 2019). However, the FGD data show that digital leadership and digital technology have weak positive integration with DBMI. This could be due to there is a third variable that will influence these direct relationship, as suggested by Mihardjo & Sasmoko (2019), co-creation strategy play a mediating role in the relationship between digital leadership and business model innovation in Industry 4.0. In the similar vein, in Leonardus W.W. Mihardjo et al. (2019) study, customer experience orientation can mediate this relationship too. According to the study by Hildebrandt et al., (2015), in the context of mergers and acquisitions of automobile OEMs, the relationship between digital technology and DBMI positively

moderated by three moderators, namely a) non-digital merger and acquisition experience, b) diversified merger and acquisition experience, c) early experience with digital technology in merger and acquisition.

This study provides useful knowledge and understanding for SMEs, entrepreneurs and policy makers. The findings from interview and FGD data can serve as a basis to facilitate the formulation of strategies, policies, decision making pertaining DBMI adoption among SMEs and entrepreneurs. Specifically, will update SMEs on the importance role of digital capability, digital leadership and digital technology on the successful DBMI adoption. Since both the interview findings and FGD data shows that digital capability has strong positive integration with DBMI, SMEs can have strong emphasis on the improvement of the organization's digital capability. Policymakers can provide the relevant training and development programs, as well as action plans to stimulate SMEs to adopt DBMI, resulting in higher competitiveness and contributing more to Malaysia's economic performance.

Nevertheless, this study has some limitations that could provide future study insights. This is not an empirical study, which limits the generalisability of the findings. Future studies are suggested to empirically investigate the proposed relationship, and in particular further explore the relationship between digital leadership and digital technology on DBMI. Evaluating the beta value and p-value on these direct relationships may allow better insights. Since the findings from both interview and FGD data assert that digital capability has strong positive association with DBMI, future research could delve the investigation on the mediator variable that could influence this consistent direct relationship to discover new knowledge and contribute to the DBMI literatures. The findings from prior literature, cross-theme analysis, focus group discussion and interviews collected at a single point in time limit the in-depth elaboration on the proposed research model. Future research could apply a longitudinal study to observe the drivers, changes, DBMI adoption processes and associated outcome. Lastly, the organizational age was not taken into account in the justification for DBMI adoption. Future research could consider this in their study.

ACKNOWLEDGMENTS

Support from an FRGS Grant from the Ministry of Higher Education (FRGS/1/2022/SS02/USM/01/2) is gratefully acknowledged.

REFERENCES

[1] AFUAH, A. (2002). Mapping technological capabilities into product markets and competitive advantage: The case of cholesterol drugs. Strategic Management Journal, 23(2), 171–179. https://doi.org/10.1002/smj.221

[2] BABER, W. W., OJALA, A., & MARTINEZ, R. (2019). Effectuation logic in digital business model transformation: Insights from Japanese high-tech innovators. Journal of Small Business and Enterprise Development, 26(6–7), 811–830. https://doi.org/10.1108/JSBED-04-2019-0139

[3] BATISTA, L. (2013). New business models enabled by digital technologies. A perspective from the fashion sector. Study Report for the EPSRC RCUK DE Research Project NEMODE (New Economic Models in the Digital Economy), February, 30.

[4] BLASCHKE, M., CIGAINA, M., RISS, U. V, & SHOSHAN, I. (2017). Designing Business Models for the Digital Economy. In In: Oswald G., Kleinemeier M. (eds) Shaping the Digital Enterprise. Springer, Cham. https://doi.org/10.1007/978-3-319-40967-2_6

[5] BLEICHER, J., & STANLEY, H. (2016). Digitization as a catalyst for business model innovation: A three-step approach to facilitating economic success. Journal of Business Management, 12, 62–71.

[6] BONNET, D., & WESTERMAN, G. (2015). The Best Digital Business Models Put Evolution Before Revolution. Harvard Business Review Digital Articles. http://search.ebscohost.com/login.aspx?direct=true%7B&%7Ddb=bth%7B&%7DAN=118648197%7B&%7Dsite=ehost-live

[7] BOOJIHAWON, D. K., & NGOASONG, Z. M. (2018). Emerging digital business models in developing economies: The case of Cameroon. Strategic Change, 27(2), 129–137. https://doi.org/10.1002/jsc.2188

[8] BOUNCKEN, R. B., KRAUS, S., & ROIG-TIERNO, N. (2019). Knowledge- and innovation-based business models for future growth: digitalized business models and portfolio considerations. Review of Managerial Science, 0123456789. https://doi.org/10.1007/s11846-019-00366-z

[9] BUGHIN, J., & ZEEBROECK, N. VAN. (2017). The best response to digital disruption. MITSloan Management Review. https://doi.org/10.1017/CBO9781107415324.004

[10] CARCARY, M., DOHERTY, E., & CONWAY, G. (2016). A dynamic capability approach to digital transformation: A focus on key foundational themes. European Conference on IS Management, 20–28. https://doi.org/https://search.proquest.com/docview/1949080140?accountid=14645

[11] CHAE, H. C., KOH, C. E., & PARK, K. O. (2018). Information technology capability and firm performance: Role of industry. Information and Management, 55(5), 525–546. https://doi.org/10.1016/j.im.2017.10.001

[12] CLAUSS, T., ABEBE, M., TANGPONG, C., & HOCK, M. (2019). Strategic Agility, Business Model Innovation, and Firm Performance: An Empirical Investigation. IEEE Transactions on Engineering Management, May. https://doi.org/10.1109/TEM.2019.2910381

[13] DA SILVA FREITAS JUNIOR, J. C., GASTAUD MACADA, A. C., BRINKHUES, R. A., & MONTESDIOCA, G. Z. (2017). Digital capabilities as key to digital business performance. AMCIS 2017 - America's Conference on Information Systems: A Tradition of Innovation, 2017-Augus(August).

[14] DASI, A., ELTER, F., GOODERHAM, P. N., & PEDERSEN, T. (2017). New Business Models In-The-Making in Extant MNCs: Digital Transformation in a Telco. Advances in International Management, 30, 29–53. https://doi.org/doi.org/10.1108/ JBS-10-2016-0127

[15] DE WAAL, B., VAN OUTVORST, F., & RAVESTEYN, P. (2016). The Objective-Subjective Dichotomy of Technology Revisited. 12 Th European Conference on Management, Leadership and Governance, 52–61.

[16] DEL AGUILA-OBRA, A. R., & PADILLA-MELENDEZ, A. (2006). Organizational factors affecting Internet technology adoption. Internet Research, 16(1), 94–110. https://doi.org/10.1108/10662240610642569

[17] DEPARTMENT OF STATISTICS MALAYSIA. (2020). Small & medium enterprises. https://www.dosm.gov.my/v1/index.php?r=column/cone&menu_id=bWl2aDJzM2ZieGJFTENHTWtxYUhMQT09

[18] DEPARTMENT OF STATISTICS MALAYSIA. (2023). Micro, Small & Medium Enterprises (MSMEs) Performance 2022. https://www.dosm.gov.my/portal-main/release-content/micro-small--medium-enterprises-msmes-performance-2022

[19] EL SAWY, O. A., KRAEMMERGAARD, P., AMSINCK, H., & VINTHER, A. L. (2016). How LEGO built the foundations and enterprise capabilities for digital leadership. MIS Quarterly Executive, 15(2), 141–166. https://doi.org/10.4324/9780429286797-8

[20] FAGHIH, N., DASTOURIAN, B., SAJADI, S. M., HENTEN, A., & FOROUDI, P. (2018). A framework for business model with strategic innovation in ICT firms: The importance of information. Bottom Line, 31(1), 16–41. https://doi.org/10.1108/BL-01-2018-0002

[21] FITZGERALD, M., KRUSCHWITZ, N., BONNET, D., & WELCH, M. (2013). Embracing Digital Technology: A New Strategic Imperative. MIT Sloan Management Review, 55, 1–12. https://www.capgemini-consulting.com/SMR

[22] FRANK, A. G., MENDES, G. H. S., AYALA, N. F., & GHEZZI, A. (2019). Servitization and Industry 4.0 convergence in the digital transformation of product firms: A business model innovation perspective. Technological Forecasting and Social Change. https://doi.org/10.1016/j.techfore.2019.01.014

[23] GROVER, V., & KOHLI, R. (2012). Cocreating IT value: New capabilities and metrics for multifirm environments. MIS Quarterly, 36(1), 225–232. https://doi.org/https://doi.org/10.2307/41410415

[24] GURKAN, G. C., CIFTCI, G., & OZYURT, B. (2019). Mutual relationships between digital transformation and leadership. Handbook of Research on Strategic Fit and Design in Business Ecosystems, 311–331. https://doi.org/10.4018/978-1-7998-1125-1.ch013

[25] HAMBRICK, D. C. (2016). The Palgrave Encyclopedia of Strategic Management. The Palgrave Encyclopedia of Strategic Management, 1–5. https://doi.org/10.1057/978-1-349-94848-2

[26] HAMBRICK, D. C., & MASON, P. A. (1984). Upper Echelons: The Organization as a Reflection of Its Top Managers. Academy of Management Review, 9(2), 193–206. https://doi.org/10.2307/258434

[27] HANNINEN, M., SMEDLUND, A., & MITRONEN, L. (2018). Digitalization in retailing: multi-sided platforms as drivers of industry transformation. Baltic Journal of Management, 13(2), 152–168. https://doi.org/10.1108/BJM-04-2017-0109

[28] HERMAN, J. L., & SMITH, B. (2015). Upper Echelons Theory. Wiley Encyclopedia of Management, 2012, 1–1. https://doi.org/10.1002/9781118785317.weom060209

[29] HILDEBRANDT, B., HANELT, A., FIRK, S., & KOLBE, L. M. (2015). Entering the digital era entering the digital era the impact of digital technology-related M&As on business model innovations of automobile OEMs OEMs. 2015 International Conference on Information Systems: Exploring the Information Frontier, ICIS 2015, 1–21.

[30] IBARRA, D., GANZARAIN, J., & IGARTUA, J. I. (2018). Business model innovation through Industry 4.0: A review. Procedia Manufacturing, 22, 4–10. https://doi.org/10.1016/j.promfg.2018.03.002

[31] INTERNATIONAL ASSOCIATION OF CONTROLLERS. (2017). Digital Business Model Innovations :Controlling in the Digital Transformation "Dream Car of the ICV´s Think Tank in 2017/2018." International Association of Controllers. https://doi.org/https://www.icv-controlling.com/fileadmin/Assets/Content/AK/Ideenwerkstatt/Files/Dream_Car_GMI_EN.pdf

[32] KHIN, S., & HO, T. C. F. (2019). Digital technology, digital capability and organizational performance: A mediating role of digital innovation. International Journal of Innovation Science, 11(2), 177–195. https://doi.org/10.1108/IJIS-08-2018-0083

[33] KREUTZER, R. T., NEUGEBAUER, T., & PATTLOCH, A. (2018). Digital Business Leadership: Digital Transformation, Business Model Innovation, Agile Organization, Change Management. R&D Management. https://doi.org/https://doi.org/10.1111/radm.12368

[34] LENKA, S., PARIDA, V., & WINCENT, J. (2017). Digitalization Capabilities as Enablers of Value Co-Creation in Servitizing Firms. Psychology and Marketing, 34(1), 92–100. https://doi.org/10.1002/mar.20975

[35] LEVALLET, N., & CHAN, Y. E. (2018). Role of digital capabilities in unleashing the power of managerial improvisation. MIS Quarterly Executive, 17(1), 4–21. https://doi.org/https://aisel.aisnet.org/misqe/vol17/iss1/3

[36] LI, F. (2018). The digital transformation of business models in the creative industries: A holistic framework and emerging trends. Technovation. https://doi.org/https://doi.org/10.1016/j.technovation.2017.12.004

[37] LIU, H., CHIN, Y. F. and MA, Y. (2024) 'Unraveling the Experimental Effects of Machine Learning Based Leadership and Administration on Microsystems Technology', Proceedings - 3rd International Conference on Advances in Computing, Communication and Applied Informatics, ACCAI 2024. IEEE, pp. 1–6. doi: 10.1109/ACCAI61061.2024.10602397.

[38] MARTIN-PENA, M. L., DIAZ-GARRIDO, E., & SANCHEZ-LOPEZ, J. M. (2018). The digitalization and servitization of manufacturing: A review on digital business models. Strategic Change, 27(2), 91–99. https://doi.org/10.1002/jsc.2184

[39] MENON, S., & GAN, X. T. (2020). Embracing digital technology. The Star. https://www.thestar.com.my/news/education/2020/02/02/embracing-digital-technology

[40] MIHARDJO, LEONARDUS W.W., SASMOKO, S., ALAMSJAH, F., & DJAP, E. (2019). Digital leadership role in developing business model innovation and customer experience orientation in industry 4.0. Management Science Letters, 9(11), 1749–1762. https://doi.org/10.5267/j.msl.2019.6.015

[41] MIHARDJO, LEONARDUS W.WASONO, SASMOKO, ALAMSYAH, F., & ELIDJEN. (2019). The influence of digital leadership on innovation management based on dynamic capability: Market orientation as a moderator. Management Science Letters, 9(7), 1059–1070. https://doi.org/10.5267/j.msl.2019.3.018

[42] MIHARDJO, LEONARDUS WAHYU WASONO, & SASMOKO, S. (2019). Digital Transformation: Digital Leadership Role in Developing Business Model Innovation Mediated by Co-Creation Strategy for Telecommunication Incumbent Firms. In IntechOpen. Intech open. https://doi.org/10.5772/intechopen.82517

[43] MILES, J. A. (2012). Management and Organization Theory. A Jossey-Bass Reader. John Wiley & Sons.

[44] N. Z. Y. Wong, Y. F. Chin, S. Sharif, and C. S. C. Ompok, "Data Driven Decision Making in TVET: The Impact of Augmented Reality Technology on Institutional Efficiency," J. Electrical Systems, vol. 20, no. 10s, pp. 4898–4903, 2024.

[45] NEW STRAITS TIMES. (2020, June 12). Penjana Gov grants.pdf. https://www.nst.com.my/news/nation/2020/06/600019/mdec-welcomes-penjanas-emphasis-growing-digital-economy

[46] NOORDIN, K. A. (2020). Cobots to help improve productivity of SME manufacturers. The Edge Markets. https://www.theedgemarkets.com/article/cobots-help-improve-productivity-sme-manufacturers

[47] OBERER, B., & ERKOLLAR, A. (2018). Leadership 4.0: Digital Leaders in the Age of Industry 4.0. International Journal of Organizational Leadership, 7(4), 404–412. https://doi.org/10.33844/ijol.2018.60332

[48] PANDA, B. K. (2019). Application of business model innovation for new enterprises. Journal of Management Development, 39(4), 517–524. https://doi.org/10.1108/JMD-11-2018-0314

[49] PARIDA, V., SJODIN, D., & REIM, W. (2019). Reviewing literature on digitalization, business model innovation, and sustainable industry: Past achievements and future promises. Sustainability (Switzerland), 11(2). https://doi.org/10.3390/su11020391

[50] RACHINGER, M., RAUTER, R., MULLER, C., VORRABER, W., & SCHIRGI, E. (2018). Digitalization and its influence on business model innovation. Journal of Manufacturing Technology Management, 30(8), 1143–1160. https://doi.org/10.1108/JMTM-01-2018-0020

[51] RANTALA, T., UKKO, J., SAUNILA, M., PUOLAKOSKI, H., & RANTANEN, H. (2019). Creating sustainable customer value through digitality. World Journal of Entrepreneurship, Management and Sustainable Development, 15(4), 325–340. https://doi.org/10.1108/WJEMSD-08-2018-0077

[52] RAYNA, T., & STRIUKOVA, L. (2014). The impact of 3D printing technologies on business model innovation. In P. H. (eds) Benghozi P., Krob D., Lonjon A. (Ed.), Digital Enterprise Design & Management. Advances in Intelligent Systems and Computing (Vol. 261, pp. 119–132). Springer, Cham. https://doi.org/10.1007/978-3-319-04313-5_11

[53] REMANE, G., HANELT, A., NICKERSON, R. C., & KOLBE, L. M. (2017). Discovering digital business models in traditional industries. Journal of Business Strategy, 38(2), 45–54. https://doi.org/10.1108/JBS-10-2016-0127

[54] RIERA, C., & IIJIMA, J. (2019). The Role of IT and Organizational Capabilities on Digital Business Value. Pacific Asia Journal of the Association for Information Systems, 11(2), 67–95. https://doi.org/10.17705/1pais.11204

[55] SEHLIN, D., TRUEDSSON, M., & CRONEMYR, P. (2019). A conceptual cooperative model designed for processes, digitalisation and innovation. International Journal of Quality and Service Sciences, 11(4), 504–522. https://doi.org/10.1108/IJQSS-02-2019-0028

[56] SLYWOTZKY, A., & MORRISON, D. (2001). Becoming a digital business: it's not about technology. Strategy & Leadership, 29(2), 4–9. https://doi.org/10.1108/10878570110387671

[57] SME CORPORATION MALAYSIA. (2018). SME Annual Report 2017/18. https://www.smeinfo.com.my/publication/sme-annual-report?view=simplefilemanager&id=40

[58] SME CORPORATION MALAYSIA. (2023). SME Definitions. https://www.smecorp.gov.my/index.php/en/policies/2020-02-11-08-01-24/sme-definition

[59] SME CORPORATION MALAYSIA & HUAWEI TECHNOLOGIES (M) SDN BHD. (2018). Accelerating Malaysian digital SMEs: Escaping the computerisation trap. https://www.huawei.com/minisite/accelerating-malaysia-digital-smes/index.html

[60] STILL, K., SEPPANEN, M., KORHONEN, H., VALKOKARI, K., SUOMINEN, A., & KUMPULAINEN, M. (2017). Business Model Innovation of Startups Developing Multisided Digital Platforms. IEEE 19th Conference on Business Informatics, 2, 70–75. https://doi.org/10.1109/CBI.2017.86

[61] STRUTYMSKA, I., KOZBUR, G., DMYTROTSA, L., SOROKIVSKA, O., & MELNYK, L. (2019). Influence of Digital Technology on Roadmap Development for Digital Business Transformation. 2019 9th International Conference on Advanced Computer Information Technologies, ACIT 2019 - Proceedings, 333–337. https://doi.org/10.1109/ACITT.2019.8780056

[62] SUHENDRA, A. A. (2017). Increasing Business Performance in the Digital Era through Improving Business Models. Journal of Business and Economics Review, 2(2), 9–16. www.gatrenterprise.com/GATRJournals/index.html

[63] TEECE, D. J. (2018). Business models and dynamic capabilities. Long Range Planning, 51(1), 40–49. https://doi.org/10.1016/j.lrp.2017.06.007

[64] TEECE, D., & PISANO, G. (1994). The dynamic capabilities of firms: An introduction. Industrial and Corporate Change, 3(3), 537–556. https://doi.org/10.1093/icc/3.3.537-a

[65] TEOH, M. F., AHMAD, N. H., ABDUL-HALIM, H., & KAN, W. H. (2023). Digital Business Model Innovation Among Small and Medium- sized Enterprises (SMEs). Global Business and Organizational Excellence. https://doi.org/https://doi.org/10.1002/joe.22200

[66] TRISCHLER, M. F. G., & LI-YING, J. (2022). Digital business model innovation: toward construct clarity and future research directions. Review of Managerial Science. https://doi.org/10.1007/s11846-021-00508-2

[67] URBINATI, A., CHIARONI, D., CHIESA, V., & FRATTINI, F. (2018). The role of digital technologies in open innovation processes: an exploratory multiple case study analysis. R&D Management, 50(1), 136–160. https://doi.org/10.1111/radm.12313

[68] VALENTINE, E., & STEWART, G. (2015). Enterprise business technology governance: Three competencies to build board digital leadership capability. Proceedings of the Annual Hawaii International Conference on System Sciences, IEEE Computer Society. https://doi.org/10.1109/HICSS.2015.539

[69] VEIT, D., CLEMONS, E., BENLIAN, A., BUXMANN, P., HESS, T., KUNDISCH, D., LEIMEISTER, J. M., LOOS, P., & SPANN, M. (2014). Business models: An information systems research agenda. Business and Information Systems Engineering, 56(1), 45–54. https://doi.org/10.1007/s12599-013-0308-y

[70] VENDRELL-HERRERO, F., PARRY, G., BUSTINZA, O. F., & GOMES, E. (2018). Digital business models: Taxonomy and future research avenues. Strategic Change, 27(2), 87–90. https://doi.org/10.1002/jsc.2183

[71] VENKATESH, R., & SINGHAL, T. K. (2018). Clarifying Determinants of Business Innovation Capabilities for Technology Driven Entrepreneurial Firms. International Journal of Applied Engineering Research (IJAER), 13(13), 11305–11315. http://www.ripublication.com/ijaer.htm

[72] VERHOEF, P. C., & BIJMOLT, T. H. A. (2019). Marketing perspectives on digital business models: A framework and overview of the special issue. International Journal of Research in Marketing, 36(3), 341–349. https://doi.org/10.1016/j.ijresmar.2019.08.001

[73] WASONO, L. W., & FURINTO, A. (2018). The effect of digital leadership and innovation management for incumbent telecommunication company in the digital disruptive era. International Journal of Engineering and Technology(UAE), 7(2), 125–130. https://doi.org/10.14419/ijet.v7i2.29.13142

[74] WESTERMAN, G., BONNET, D., & MCAFEE, A. (2012). The digital capabilities your company needs. MIT Sloan Management Review. https://sloanreview.mit.edu/article/the-digital- capabilities-your-company-needs/

[75] WETERING, R. VAN DE, VERSENDAAL, J., & WALRAVEN, P. (2018). Examining the relationship between a hospital's IT infrastructure capability and digital capabilities: A resource-based perspective. Americas Conference on Information Systems 2018: Digital Disruption, AMCIS 2018, 1–10.

[76] WIESBOCK, F. (2019). Innovating in a Digital World – The Role of Digital Product Innovation Capabilities. Proceedings of the 27th European Conference on Information Systems (ECIS), 0–16.

[77] WIKSTROM, P., & ELLONEN, H. K. (2012). The impact of social media features on print media firms' online business models. Journal of Media Business Studies, 9(3), 63–80. https://doi.org/10.1080/16522354.2012.11073552

[78] WOERNER, S. (2019). A digital business model expert describes the key questions today's leaders need to ask (K.Christensen, Interviewer). Rotman Management Winter.

[79] WULF, J., METTLER, T., & BRENNER, W. (2017). Using a digital services capability model to assess readiness for the digital consumer. MIS Quarterly Executive, 16(3), 171–195.

[80] ZAKI, M. (2019). Digital transformation: harnessing digital technologies for the next generation of services. Journal of Services Marketing, 33(4), 429–435. https://doi.org/10.1108/JSM-01-2019-0034

[81] ZHOU, K. Z., & WU, F. (2010). Technology capability, strategic flexibility and product innovation. Strategic Management Journal, 31, 547–561. https://doi.org/10.1002/smj.830