



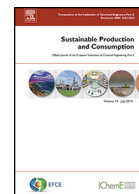
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Perspective Article

COVID-19 pandemic digitization lessons for sustainable development of micro-and small- enterprises

Chunguang Bai^a, Matthew Quayson^{a,d,e,*}, Joseph Sarkis^{b,c}

^a School of Management and Economics, University of Electronic Science and Technology of China, Chengdu 611731, China

^b Foisie Business School, Worcester Polytechnic Institute, Worcester, MA 01609, USA

^c The Humlog Institute, Hanken School of Economics, 00100, Helsinki, Finland

^d Center for West African Studies (CWAS), University of Electronic Science and Technology of China, Chengdu, China

^e Department of Logistics and Supply Chain Management, Ho Technical University, Ho, Ghana

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ABSTRACT

The coronavirus (COVID-19) pandemic has undeniably influenced the global economy and environment. Major victims of the COVID-19 outbreak are Micro and Small Enterprises (MSEs), especially in developing countries, mainly because of limited use of digital technologies. This paper employs a literature review and personal insights to provide COVID-19 pandemic digitization lessons for sustainable development of MSEs from a technology for social good perspective. We develop a framework to support post COVID-19 digital transformation for sustainable development of MSEs. We find that digital payments, especially mobile money, should be a critical digital transformation priority for MSEs. Also, institutions must support MSE resources and capabilities to adopt digital transformation for business continuity, and sustainable production and consumption. Our study suggests that MSE managers and other stakeholders rethink their business strategies, incorporating crisis scenarios and business continuity plans to sustain customers virtually to enhance sustainable development. We also propose further research areas to improve the successful digital transformation of MSEs post COVID-19.

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1. Introduction and background

The coronavirus (COVID-19) pandemic has had significant effects on global economies (Fernandes, 2020). It has impacted capital and supply chains influencing the distribution and availability of products. For example, factory closures and reduced supply caused China's factories to cease production because of decreased demand for automotive parts, components, and clothing (Wang and Su, 2020).

Lockdowns worldwide and the shutdown of major industries such as hospitality, travel, and retail led to significantly higher unemployment rates worldwide. The negative global economic impact in such a short period of time has been unprecedented (Ozili and Arun, 2020).

Eurostat's (2020) report suggests that Gross Domestic Product (GDP) has fallen by 3.8 % in the first quarter within the Eurozone. This represents the sharpest drop since records were first compiled in 1995, ranging from -4.7 % to -5.8 % in Italy, Spain, and France

(Fernandes, 2020). The impact of COVID-19 on the US economy has been even more devastating, as it shrunk in the first quarter by 1.2 %, its largest decline since the financial crisis (PWC, 2020). Although recovery continues, many areas of the world faced similar declines in economic performance.

In the UK economy, the decline in outputs has been around 2%, although according to a report by the Office for National Statistics (ONS) the monthly GDP estimate declined by 10.4 % for March and April 2020; this is the largest fall ever recorded (ONS, 2020). At the same time, governments worldwide are issuing policies and implementing action plans, including restrictions to prevent the spread of the COVID-19 outbreak. Those restrictions have implications for businesses' sustainable operations, including reducing business activities and HR issues related to staffing and supply chain disruptions.

The COVID-19 restrictions are more severe on micro and small enterprises (MSEs) when compared to larger and global firms (Shafiand et al., 2020). This situation poses a serious threat to the economy considering the role of MSEs. For instance, at the start of 2020, there were 5.94 million small businesses in the UK, constituting 99.3% of the total business, employing 13.3 million people with a turnover of 1.6 trillion (Federation of Small Business, 2020).

* Corresponding author at: School of Management and Economics, University of Electronic Science and Technology of China, Chengdu 611731, China.

E-mail address: matthew.quayson@yahoo.com (M. Quayson).

Notwithstanding the COVID-19 pandemic's global nature and its implications, much of the discourse and investigation has focused on large developed and emerging economy regions such as Europe, the United States, and China (Jurd De Girancourt et al., 2020; Quayson et al., 2020). This global pandemic does not recognize national borders. The issues faced by smaller and vulnerable developing economies and regions are equally profound ().

Developing nations have also banned international flights, closed borders, adopted large-scale quarantines, banned large-scale gatherings, and implemented partial lockdowns. To provide basic essential services, the food industry, banking, construction, and front-line health care are deemed essential industries in these nations. Micro- and small enterprises (MSEs) in developing economies have been most vulnerable during this crisis (Korankye, 2020). These enterprises typically have less than 50 workers and sometimes are frequently small family-run enterprises with one or two employees.

MSEs are a major driving force for sustainable and social development in developing nations (Oppong et al., 2014). For example, they represent more than 90 percent of businesses on the African continent (UNCTAD, 2020). MSEs play an important role in stabilizing employment rates and income for many informal, vulnerable, and disadvantaged groups (Blankson and Nukpezah, 2019).

MSEs are also a primary source of environmental pollution (He et al., 2014). Sensitive environmental issues in these developing nations exist across sectors, including farming with biodiversity and deforestation, mining with deforestation and hazardous waste, and electronic waste with solid and hazardous waste.

MSEs could strengthen their sustainability transformation during this crisis. Home telework, virtual conferences, and online shopping continue to gain popularity. Some food supply chain MSEs—such as restaurants, cafeterias, and retail enterprises, operate remotely and allow online ordering, picking up, and delivery. The COVID-19 pandemic virtually opened up new MSEs opportunities.

Few developing nation MSEs are formal and follow the latest business practices (Xu et al., 2020). MSEs are characterized by low efficiency, operating out of residences, in open spaces, or dilapidated structures (Mohanty and Mishra, 2020). They lack operating funds, have limited access to technology and equipment, have weak institutional support, and are characterized by poor managerial competencies (Singh et al., 2019). They rarely go beyond local activities and markets.

While the COVID-19 pandemic has had cross-industry influences, informal MSEs are even more profoundly influenced (Shafi et al., 2020). Indeed, MSEs have lower capital reserves, less inventory, and lower productivity than larger businesses, mostly dependent on one-on-one transactions, rendering them more vulnerable to crises (Liu and Cheng, 2018). Also, in times of crisis, small companies and leaders face obstacles. While MSEs might not have significant overhead, they are also financially committed to employee wages and facility costs (Xu et al., 2020).

Due to their scale and versatility, MSEs are seeking new markets and are designing evolving strategies for sustainable business activities. Yet, the COVID-19 pandemic has exposed the frailty and vulnerability of many developing nation MSEs. Many MSEs may also not be formally formed, as they could be individuals or family members who jointly form their markets to sell wares and goods in public markets—an informal economy. McKinsey estimates that 50 million informal sector jobs across Africa – in sectors like wholesale, retail, trade, and manufacturing – are vulnerable to economic shocks from the pandemic. The informal economy in some developing countries—such as Nigeria—may represent 70% of the GDP (Ayyagari, et al., 2007).

In response to the outcry by informal workers and their reaction to the government's COVID-19 protocols, the Corona Virus

Alleviation Programme (CAP) was announced by the President of Ghana on April 5, 2020, in a televised address (Korankye, 2020).

In the CAP package, Ghana's government dedicated GHS 600million funds to be deployed through the National Board for Small Scale Industries (NBSSI) (Akuoko et al., 2021). Most importantly, the CAP acknowledges that Micro Small and Medium Enterprises (MSME) are distressed by the impact of COVID-19 and that 40% percent of these MSME are women-led and that these women are breadwinners of their homes (Akuoko et al., 2021). Moreover, the NBSSI acknowledges the fact that the micro-enterprises are mostly of the informal sector.

The informal economy is especially pertinent to sustainable supply chains due to a product's end-of-life cycle (Hilson and Maconachie, 2019). For example, one of the most common examples of the informal economy—for good or bad—is the management of e-waste and urban waste heavily dependent on informal economy players' governance and involvement (Mohanty and Mishra, 2020).

In the COVID-19 pandemic, digitization technologies have become more critical (Nandi et al., 2020). However, the lack of digitization, technology adoption, and limited online presence of MSEs has made the pandemic even more damaging for them; increasing MSEs vulnerability, especially for individuals and family businesses (Bartik et al., 2020). It is not clear how long this pandemic will persist globally. It is also more uncertain that we will return to the previous normal state. COVID-19 has challenged and will likely introduce new digitization technologies within the supply chain context, many of which affect supply chain sustainability. Digitization may be a significant differentiator for MSEs who survive this pandemic (Akpan, et al., 2020; Katz, et al., 2020).

Our perspective paper discussion focuses on how COVID-19 pandemic digitization lessons for sustainable development of MSEs may influence post-COVID-19 resilience for MSEs; a technology for social good perspective. We develop a framework to support post-COVID-19 digital transformation for sustainable development of MSEs and suggest practical and research implications to enhance the successful digital transformation of MSEs post-COVID-19.

We proceed with the paper as follows; In Section 2, we discuss the theoretical and literature background of the study with insights for the MSEs situation. Section 3 presents the practical implications of the study. In section 4, we provide the research implications and future directions. We provide a conclusion in section 5.

2. Literature review

In this section, we present the theoretical background of MSEs digital transformation process, insights for MSEs digital transformation in post-pandemic, and some relevant organizational theoretical underpinnings of our study (e.g. Institutional theory, Resource based view (RBV), Dynamic capability theory, Transaction cost theory, TOE framework). These theories have reference value for further studies on the potential research fields provided by this paper. Regarding these theories, we develop a framework (see Fig. 2) to support COVID-19 pandemic digitization lessons for the sustainable development of MSEs.

2.1. Digital transformation process of micro and small enterprises

Digital transformation by MSEs has received much research effort over the last two decades (Barann et al., 2019). The extant literature has discussed digital transformation in terms of its enablers (Martín-Gómez et al., 2019), required resources and capabilities (Li et al., 2018), transformation processes and modes (Bienhaus and Haddud, 2018), and benefits (Barann et al., 2019).

Transformational IT evolved over the decades. Earlier, firms were mainly concerned about deploying internal management information systems such as Enterprise Resource Planning or Cus-

customer Relationship Management (Narimissa et al., 2019). These transformations were primarily limited to improvements in business processes within organizational boundaries for efficiency improvement, cost reduction, and business process optimization (Teichert, 2019).

In recent years, cross-boundary technologies such as e-commerce and social media have been quickly and widely adopted by companies (Rahayu and Day, 2015). The transformations driven by such externally oriented IT go far beyond internal business process changes; they include drastic changes to business models, organizational strategy and culture, and business alliance building (Ulas, 2019).

However, digital transformation is more a managerial issue than a technical one (Matarazzo et al., 2021). Successful digital transformation demands acquiring and deploying technical resources and—perhaps even more importantly—tackling managerial issues such as redesigning business processes and training and investing in e-Commerce, human resources and organizational capabilities (Ordieres-meré, 2020).

Firms redesign the business process by adopting digital technology to improve efficiency, minimize costs, and innovate. The digital transformation includes practical internet use as a data-based management model in design, production, marketing, sales, and communication.

The digital transformation of MSEs requires the joint efforts of government and enterprises (Räisänen and Tuovinen, 2020). First, the government plays a role in promoting the digital processing of MSEs. Government interference involves determining how digital transformation is strengthened by the existing legal and regulatory system. For MSEs digital transformation, the government can play a prominent role by raising digital transformation awareness, increasing labor-power competence, providing technical and financial support, and strengthening data communication infrastructure (Mukaiya Ayanda and Sidikat Laraba, 2011).

Second, despite the many benefits of digital transformation to MSEs because they are agile, dynamic, interactive, more casual and less bureaucratic than bigger organizations, their digital transformation is difficult due to poor infrastructure (Krishnamurthy, 2020).

In the digitization process, the demands of MSEs may be different (Räisänen and Tuovinen, 2020). Digital content must be privatized with the scale of the business, industry, and culture of MSEs. Digitization would bring changes in policy, market and business structure, and enterprise culture. When a digital system is applied broadly across goods and business processes, an MSE is then transformed.

Past studies have considered general technology adoption and identified a range of factors that affect the acceptance of information and communications technology for organizations (Queiroz and Fosso Wamba, 2019). Factors included business characteristics, past experiences, concerns about privacy and security, absence of a technological roadmap, digital transformation ecosystem, lack of information-sharing systems, regulatory needs resulting from digital transformation, and the assurance of a secured environment.

However, limited MSE resources and capital can prevent digital transformation. For example, although many MSEs are increasingly aware that the Internet can be the key to success, they still have no website on smartphones in many cases. Notwithstanding, other MSEs use smartphones for general business details, online banking, customer mail, payment of bills, supplies purchase, and tax payments online. The classical business model has disappeared and replaced a versatile and instantly evolving business models (Akbar and Tracogna, 2018). These new business models respond to customer behaviors in real-time and are knowledge-based. MSEs also can conduct cost-effective analyzes of digital technologies.

MSEs, which have aligned to digital technologies, are relieved during the COVID-19 era.

2.2. Insights of digital transformation for micro and small enterprises in post-pandemic

Given these vulnerabilities, the post-COVID-19 period—due to pandemic pressures and basic survival needs—will likely see MSEs that are more likely to adopt digital technologies to manage their operations and supply chains. We recognize the importance and necessity of digitization technology for MSEs development and risk prevention (e.g. see Matarazzo et al., 2020). Yet, poor infrastructure, network difficulties, and high data cost have created severe digitization adoption challenges in developing countries. To overcome these digitization challenges, we provide some insights to help developing country MSEs manage the post-pandemic supply chain; environmental sustainability concerns are a core focus.

Digitization can lessen MSEs concerns about economic survival, allowing them to meet their various social and environmental obligations (Zhanna and Yana, 2020). A small fraction of MSEs—mainly urban enterprises with well-planned processes—integrate some form of digitization in their business processes (Liu and Cheng, 2018; Tengeh and Talom, 2020).

Digital payments, especially mobile money, is a critical digital transformation priority for MSEs post-pandemic (Shaikh et al., 2019). Compared to other digital tools, mobile technology appears to be widely adopted by small businesses, especially in developing countries (Mohanty and Mishra, 2020).

There has been an increase in the use of mobile money-payment by African governments to disseminate stimulus funds to assuage the economic impact of the COVID-19 crisis. This policy deepens financial inclusion outside the traditional bank establishments (Bazarbash et al., 2020). Some areas are also implementing social protection programs using mobile money to support workers, especially those in the informal sector (World Bank, 2020). For instance, in Kenya, the government approved fee waivers on person-to-person mobile money transactions on M-PESA (Jurd De Girancourt et al., 2020). Similarly, Ghana also suspended for three months any financial charges on mobile money transfers that do not exceed Hundred Ghana Cedi (GH¢100). The Central Bank of West African States also provided more flexible measures to open mobile money accounts and conduct personal transfers, to promote the use of electronic payment tools in Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo (World Bank, 2020).

Sub-Saharan Africa has the largest number of registered mobile money accounts globally, at around 400 million, and most unbanked adults own a mobile phone (World Bank, 2020). In most of these countries, mobile money is more popular than banks (see Fig. 1). MSEs can take advantage because most of the unbanked are in the informal sector and are the main customers of MSEs (Senyo and Osabutey, 2020). Most MSE owners are habitually compelled to leave their premises unattended for numerous hours a day when they visit the bank or even close down, therefore losing sales. This traditional requirement negatively impacts their survival.

Physical distancing measures are likely to carry over into a post-COVID-19 world. Also, Online delivery and payment services during the lockdown will continue even after the pandemic. This means that mobile money will continue to play a crucial role and result in prevalent use.

MSEs must evolve post-pandemic, and mobile money provides the right opportunity. For instance, mobile money will enable the MSEs to collect receivables straight from customers and make direct payments to suppliers using their cellphone without having to close or leave their premises for hours. It will bridge the un-

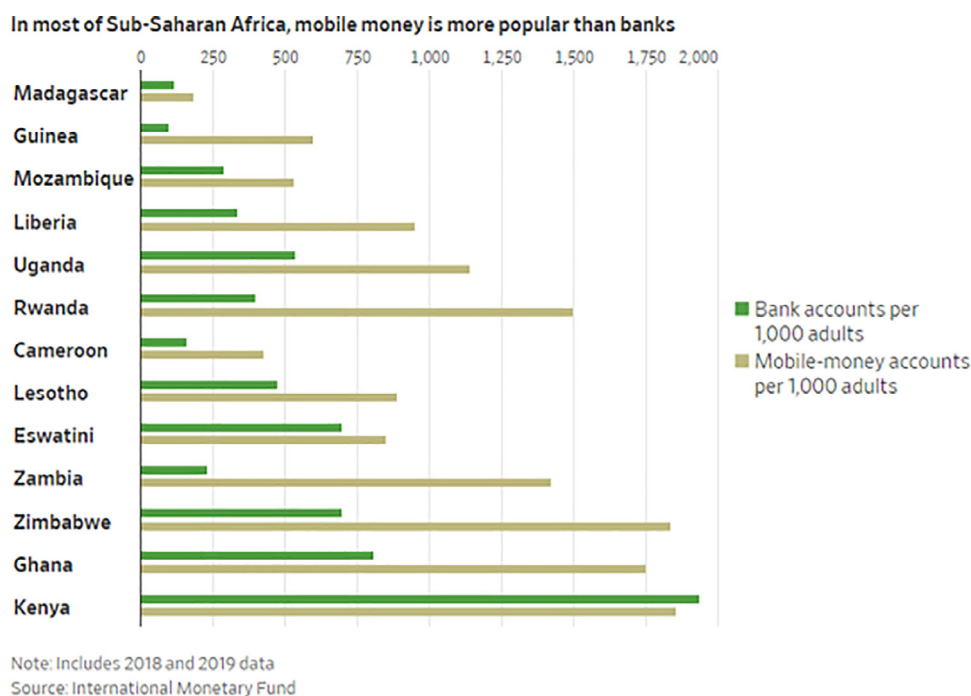


Fig. 1. Mobile Money and Bank Account holders in selected African countries.

banked financial inclusion, reduce the risk of carrying cash, and enable MSEs to access the mobile money platform's loans.

MSEs mobile pay services for small businesses exist, such as MTN MoMo pay. MoMo Pay has shown considerable early success in driving the digitization of payments in Ghana's cash-dominated economy (Shaikh et al., 2019). MoMo Pay is a merchant payment service that encourages customers to digitize transactions with sellers, paying for products and services through MTN Mobile Money rather than cash. Merchants are not charged to transfer money from their merchant account to their bank account, from which they can cash out for free.

MSEs could use various communication platforms, including websites, social media, traditional media, and text messaging, to educate customers about mobile money payments. MSEs must also be aware of the risks and fraud associated with mobile money transactions, such as false transactions, sending fake text messages to make customers believe a successful transaction (Gilman and Joyce, 2012). These negatively impact profitability and operations. Therefore, service providers and regulators should engage in frequent dialogue, and regulators should closely monitor evolving risks in the payment system to minimize these risks.

Despite the proliferation of digital solutions, many rural and urban enterprises know little of digitalization (Räisänen and Tuovinen, 2020). Many MSEs in the informal economy do not have appropriate and official documentation (Xu et al., 2020). For example, 80% of the MSEs in Kenya's informal sector comprise unlicensed enterprises collectively known as the "Jua Kali" (Siddiqui et al., 2020). They will get minimal support from the stimulus package of the government. The package will largely cater to MSEs in the formal sector Government stimulus packages that some developing nations offer in response to the COVID-19 crisis will be unlikely to identify and pay vulnerable MSEs (CGAP, 2020). Most informal MSEs will be excluded from recovery stimulus financing due to lack of documentation. We believe that having digital identity and records of MSEs would facilitate better inclusion of such enterprises, enable better protection in the future; and further support various sustainability and circular economy practices dominated by the informal sector.

Digitally enabled MSEs can potentially improve employment prospects, reduce poverty, and improve sustainable development through further inclusion into society, providing them greater reason to practice social and environmental sustainability (Räisänen and Tuovinen, 2020). Digitization technology can make the process of sustainable development more participatory and inclusive (Isensee et al., 2020). To integrate these MSEs, especially those that contribute to waste management, circular economies, and improved social and environmental sustainability, a series of digitization technologies can be integrated to achieve sustainable environmental performance (Fatimah et al., 2020). Post COVID-19 stimulus packages¹ provide an opportunity to do this. Not only will digitization support supply chain business and economic resilience, but it can also support environmental and social sustainability goals.

Given MSE vulnerability, it is up to supply chain partners to cooperate in diffusing digital tools and integrating MSEs. Governmental development efforts can supplement these supply chain partner efforts and should include broader social digitization investment. The introduction of digital address systems, mobile money interoperability, and digitization of public agencies and institutions (such as marine ports) can be supported and developed. These efforts require broad information and communication technology (ICT) infrastructure investment; most likely through public agency effort.

MSEs have limited funds, and most of them do not have financial reserves to meet expenses during emergencies. For example, only 39% of Kenyans have set aside funds to manage emergencies that arise from income loss (Siddiqui et al., 2020). Therefore, formal resource-rich organizations should deploy resources to integrate MSE's into their supply chains; it means more efficient, effective, and sustainable opportunities (Ali et al., 2018).

¹ A comprehensive tracking, listing and evaluation of Post-COVID 19 stimulus policies and economic responses by governments from 197 countries can be found at the International Monetary Fund website at: <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19>. Measures including tax and spending, loans and guarantees, monetary instruments, and foreign exchange operations policies.

Digitization can leverage supply sustainability practices (Doyle and Cosgrove, 2019). Digitization and sustainability practices together should be part of strategic plans for organizations of all sizes who competitively survive for the long-term. A positive and significant relationship between IT use and various corporate social responsibility (CSR) categories—economic, legal, ethical, and discretionary responsibilities in MSEs—has been found (Malaquias et al., 2016).

Digitization can help make CSR information more easily available to stakeholders and create new possibilities of linking information on company impacts with other sources, providing easier access to information through the Internet, developing sustainable awareness. Digitalization has also been found to positively impact environmental sustainability (Chen and Despeisse, 2020). But the findings have also been mixed, as some studies revealed that MSEs smart technologies do not directly influence environmental or social sustainability (Saunila et al., 2019). Yet, corporate sustainability strategy does fully mediate the relationship between smart technologies and corporate sustainability in environmental sustainability and social sustainability (Saunila et al., 2019).

Lack of awareness hinders digitization for sustainability and resilience (Ordieres-meré, 2020). Thus, to increase green and sustainable digital maturity, MSEs have to improve relevant internal capabilities and transformations in “people and culture” and “governance.” Management tasks include providing adequate resources, integrating the digital agenda into vision statements, the organizational sustainability strategy, centralized decision-making, collaboration, and communication of values (Baggia and Maleti, 2019).

The internal factors driving MSEs environmental sustainability and digital development and their interactions have been given limited attention in the literature (Jovanovicand et al., 2018). The interdependence of organizational culture, environmental sustainability, and digitization remains poorly understood. MSEs decision makers miss an opportunity to use these powerful instruments to fully understand and consider different interests.

Volatility in technological environments on sustainability of MSEs in developing countries has seen some investigations. (Das et al., 2020). It was found that both institutional capabilities and external capabilities both play significant roles in effectively managing this volatility. Institutional capabilities have a strong impact on sustainability of MSEs compared to external capabilities in high technologically volatile environments. This situation provides an opportunity to further evaluate this volatility and sustainability relationship. Along this line of volatility and sustainability, it has been found that MSEs that deploy digitization resources across business processes are more likely to survive uncertainty and be more sustainable in a pandemic era (Chen et al., 2021; Doyle and Cosgrove, 2019).

In Table 1 we summarize various digital applications applied across different MSEs business dimensions in relation to sustainability and resilience. While external circumstances lead enterprises to adopt several resilience measures to better respond to the pandemic, the motivations that are most relevant in this decision are generally internal.

Many governments and other stakeholders have given priority to MSEs digitization. For example, Indonesia had started to digitize MSEs even before the COVID-19 pandemic. The country launched initiatives such as the 2018 Making Indonesia 4.0 Roadmap, the 2019 E-Commerce Roadmap, and the 2020 Go Digital Vision to support the sustainable competitiveness of MSEs in the digital economy (Sakudo, 2021).

To aid MSEs digitization during the pandemic, the Indonesian government has partnered with Grab Indonesia’s GrabMerchant mobile app, a one-stop service platform for MSEs in the food and beverage industries. Likewise, social media networks such as Tik

Tok, Instagram, and Tokopedia have launched new advertising services for MSEs (Sakudo, 2021).

Also, as part of the response to the novel COVID-19 pandemic in Uganda, The United Nations Development Programme (UNDP) partnered with Jumia Food Uganda to launch an e-commerce platform to sustain supply chains for MSEs and to connect them with consumers online (UNDP UGANDA, 2020).

Again, in Malaysia, stakeholders have engaged LOCUS-T as a Technology Solution Provider (TSP) to assist MSEs in their digitization efforts (The Star, 2020).

Blockchain and synergistic digitization tools can help MSEs connect with suppliers and customers to ensure resilient and sustainable supply chain activities (Bai and Sarkis, 2020).

Cellulant Agrikore and Hara Technology have successfully applied blockchain technology in the agriculture industry, creating financial inclusion and connecting farmers directly to buyers, which provide evidence of this claim (Quayson et al., 2020). Smallholder farmers in Ghana, Kenya, and Indonesia have been incentivized through the Internet of Things (IoT) and blockchain technology to become more formalized organizations (de Boer et al., 2019). Other sectors, such as retail, can adopt these innovations with electronic payment systems.

MSEs are also critical to the circular economy, environmental protection, and social responsibility (Katz-Gerro and Sintas, 2019). If MSEs adopt environmentally friendly and circular business models as part of the supply chain, they can acquire new economic opportunities. MSEs can coordinate organizational commitment and socio-cultural practices to reduce energy consumption, reuse, and recycle local waste generated by them (Ünal et al., 2019); allowing for savings and new revenue streams. For example, consider Zabaleen in Cairo, as an informal MSE, that recycles polyethylene terephthalate (PET) to enhance the circular supply chain (Jaligot et al., 2016). Circular economy practices can be enhanced by digitization, leading to the localization of supply chains to improve resiliency (Sarkis et al., 2020). Care must be taken when digitizing and formalizing these circular activities for stronger local production of materials and corporate resiliency. There are inclusion issues for digitalization and circular economy sustainability efforts; for example, the digital divide may cause MSEs to lose a voice in a formalized and digitalized circular economy (Duncombe and Heeks, 2002).

Without critical means, many MSEs will not survive this crisis (Dutta et al., 2020; Ncube, 2020). Supportive activities may be economical and technological. A broad and thoughtful set of policies and technology tools can be used to support the transition towards sustainability of MSEs. More inclusive research is needed in both the public and private sectors to understand how post-COVID-19 activities will influence the most vulnerable organizations and individuals in developing economies.

2.3. Institutional theory

Institutional theory can be used as a reason for the digitization of MSEs (Jean et al., 2020). The core principle of institutional theory is that an organization is incorporated and informed by the institutions’ standards and practices to which firms ultimately adhere (Gupta and Gupta, 2020). Institutional theory can help decide whether the digitization plan is driven internally or externally and its adoption rationale. The institutional theory makes it possible to analyze how MSEs respond to digitization pressures during and after COVID 19 period. Researchers use isomorphic pressures to differentiate forces and establish particular characteristics related to their use and implementation (Kummer et al., 2020). This isomorphism can be divided into three parts within the institutional theory: coercive, normative, and mimetic pressures (Latif et al., 2020). We discuss how these influence digitization of MSEs.

Table 1
Business dimensions and effects of digital applications on sustainability and resilience of MSEs (Adapted from (Chen et al., 2021)).

Business Dimension	Digital transformation application	Impact on sustainability/resilience of MSE	References
Process and system	Automation tools to replace labor	Production can continue during a lockdown, and social distancing	(Chen et al., 2021; Naderi et al., 2019)
	Using Point of Sale (POS)	Reduce the cost of production to increase profit	(Narayanan et al., 2019)
	Demand for digital learning platforms	Increase employee skill to be more productive	(Dwivedi et al., 2020)
	Demand for energy-efficient technology	Reduce energy use and enhances environmental sustainability	(Singh et al., 2019)
	Information system of Business to Business(BandB)	Enhances customer experience that increases sales and profit	(Clohessy and Acton, 2019)
	Recycling technology	Reduce environmental pollution caused by waste	(Liu et al., 2020)
	Using tools for customer data analysis	Predict customer preference and sales to increase profit	(Akter et al., 2020)
	Green IT	Smart use of IT that lowers the environmental impact of manufacturing, operations, etc	(Baggia and Maletti, 2019)
	Inventory management system	Avoid excess stocked inventory and potential shortage, thereby increasing profit	(Chebet, 2019)
	Integrate e-commerce, mobile multimedia, and manufacturer app into one system	The use of digital marketing tools enhances customer experience to increases sales and profit	(Day and Schoemaker, 2016)
Customers	Social media account and social media advertising	Customer virtual engagement to drive sales even partial lockdown	(Akpan et al., 2020)
	Online auction	Increase sales and virtual customer experience	(Tang, 2019)
	Live broadcast	Virtual engagement with customers to increase sales and customer experience	(Chen et al., 2021)
	Chat robot	Reduce human to human contact that drives sales during restrictions	(Pillai, 2020)
	Demand environmentally friendly production technologies	Reduce environmental pollution	(Chen and Despeisse, 2020)
	e-commerce for sales channel	Increases sales and profit	(Ulas, 2019)
	Have a website for selling	Increases sales and profit even in contact restrictions	(Fitriasari, 2020)
Products	Platform to resell and donate items	Reduces waste and environmental pollution	(Jovanovic et al., 2018)
	Free WiFi	A better customer experience that increases profit	(Chen et al., 2021)

2.3.1. Coercive pressure and the digitization of micro and small enterprises

International buyers, foreign investors, professional associations, and transnational institutions exert coercive pressure on the environmental protection of MSEs in developing nations (Gupta et al., 2020). External entities such as regulatory authorities and non-governmental organizations also exert coercive pressure on MSEs (Zhu and Sarkis, 2007). This pressure requires the MSEs to apply various environmental rules and standards. Then, MSEs have mandatory and obligatory ecological control and standards. Institutional theory suggests that coercive pressure will form the environmental protections and legislative mandates of MSEs. Many authors have reported how coercive forces affect the ecological performance of MSEs (Latif et al., 2020). Government authorities enforce these compulsory rules and regulations. Even during the pandemic, MSEs should be subject to these regulations penalties for breaches.

Many government authorities also promote and provide favorable conditions for enterprises to adopt digital transformation (Chen et al., 2021). Furthermore, digitalization helps MSEs increase their environmental efficiency and gain government support while facing coercive pressures. Digitization's digital divide may be a coercive deterrent—with formalized barriers and rules and regulations—that limit MSEs involvement. Coercive forces can support or deter MSEs needing to digitize (Wang et al., 2020).

2.3.2. Normative pressure and digitization of micro and small enterprises

Normative pressure arises from vendors, consumers, groups such as trade unions, media and other social organizations. Trade unions and other associations are generally regarded as the key organizations which create regulatory pressures (Kornilaki and Font, 2019). Developing nations view regulatory power as a catalyst for affecting expectations and a sense of obligation. These ex-

pectations exist because regulatory constraints influence attitudes and behaviors that are under social expectations. Regulatory pressure ensures that external consumers and vendors use them in socially respectful ways, thus allowing environmental and social responsibility behavior and digital transformation to be easily monitored (Latif et al., 2020). The culture and efficiency of businesses influence trade union members. Enterprises adopt non-detrimental trade unions' policies because they impact capital, expertise, and corporate culture (Fassin and Buelens, 2011).

Digital transformation can help MSEs to manage public opinion, especially on environmental concerns, through visibility, connectivity, and management. When MSEs do not manage public opinion, these opinions may impact their image and credibility. MSEs with damaged reputations may also suffer from external losses and lose their benefits. Therefore, digitalization affects the credibility and competitive advantage of MSEs.

2.3.3. Mimetic pressure and digitization of micro and small enterprises

Digital transformation enables MSEs to react to mimetic pressure and give competitive advantages (Latif et al., 2020). MSEs need to adapt to the acts and behaviors of their competitors. If competitors adopt emerging digital technologies, MSEs can follow suit. Mimetic pressure in developing nations facilitates enhanced environmental protection through domestic and multinational enterprises (Chaudhry and Amir, 2020). The intense mimetic pressure will influence governments and stakeholders to ensure that MSEs implement the most effective digital technologies. MSEs can gain economic benefits by being more competitive, especially within certain industries, and adopting certain practices. Mimetic pressures are powerful not only as forces for change, but as avenues for learning. For example, it is likely that MSEs that see successful implementation of digitization for sustainability will adopt due to

less perceived risks and potential new markets from these digitalization efforts by similar companies.

In the context of digitization, the institutional theory research should explore how MSEs strive to monitor institutional pressures in space, resources, and innovations, particularly how creative methods lead to mimetic processes among competitors. Overall, institutional theory can be used to research why MSEs should embrace emerging innovations.

2.4. The resource-based view

RBV, also known as resource-based theory, focuses on resources and their capabilities that an organization already owns or could own to build a competitive advantage. RBV provides an examination of intra-organizational relationships of resources and their capabilities to explain why and how some organizations outperform others—gain competitive advantages. RBV argues that an entity's resources may be physical, human, or organizational and valuable, uncommon and inimitable (Cruz and Haugan, 2019).

Organizational resources and capabilities have emerged as core strategic theoretical lenses. Tangible and intangible resources help firms establish competitive relational capabilities. Knowledge capability can build intangible resources and allow dynamic organizational learning in organizations for environmental and social sustainability. Relational capability is meant to augment alliance partner resources to create, extend or modify their resource bases.

RBV helps better understand the relationship between firm resources and building post-COVID-19 supply chain resilience (Nandi et al., 2020). As a result, Nandi et al., (2020) applied RBV and resource-dependent theories to investigate supply chain disruptions during COVID-19. They found that firms develop localization, agility, and digitization capabilities by applying their critical circular economy and blockchain technology-related resources they either already possess or acquire from external agents.

RBV supports the supposition that digitization is an example of organizational capability. Digitization can support other resources, structure, growth strategies, metrics, and goals (Verhoef et al., 2019). RBV provides a useful lens to view MSEs digitization as a capability for them to survive and also be more sustainable (Eller et al., 2020). Drawing on the RBV, we can better understand the relationship between MSEs and their information technology (IT), employee skills, digital strategy, and digitization.

However, in major disturbances and extreme events, such as the COVID-19 pandemic, it is challenging to build this relationship (Papadopoulos et al., 2020). Yet, an important aspect of RBV is dynamic capabilities theory which can be used to explain how and why MSEs adjust their resources to sustain their competitive advantage in a constantly changing context; helping to address the challenges of the COVID-19 crisis. We discuss dynamic capabilities in the next section.

2.5. Dynamic capability theory

Dynamic capabilities have become one of the most active research streams in the strategic management literature. It is useful because it explains how firms respond to rapid technological and market change (Pieroni et al., 2019).

Dynamic capabilities are innovation-based and provide the capacity to create, extend, and modify a firm's resource base. Teece et al. (2009) argue that dynamic capabilities consist of three broad clusters: (1) sensing opportunities (and threats), (2) seizing opportunities, and (3) transforming the organization's business model and wider resource base. Building sensing, seizing, and transforming capabilities allows a firm to craft a future strategy that designs, creates, and refines a defensible business model,

guides organizational transformation, and provides a stable source for obtaining a competitive advantage (Teece, 2018).

Literature has found that MSEs face increased difficulty in adopting new technologies due to a lack of resources, skills, commitment, and understanding of digital opportunities (Rowan and Galanakis, 2020). Overcoming these difficulties will require MSEs to build these and related capabilities.

In MSEs, some capabilities reside either in the entrepreneur, owner, or the executive team. The ability to perceive new digital opportunities, change customer interactions, and co-create value with them imply changes in existing routines, resource configurations, and building new capabilities.

Dynamic capability theory could explain why MSEs change their resources to support their competitive advantage in a continuously changing context (Bag et al., 2020). Setting up and reconfiguring resources to provide capabilities would create a competitive advantage. Thus, MSEs need to begin to ensure business continuity in unpredictable environments, like the COVID-19 pandemic, through building capabilities “sensing, seizing and transforming” (Papadopoulos et al., 2020).

MSEs require sensing capabilities to scan the external environment for trends that disrupt organizational activities. Sensing (and shaping) new opportunities [and threats] is a scanning, creation, learning, and interpretative activity that analyzes diverse information about trends in the business ecosystem (Khan et al., 2020). Therefore, sensing should occur at all levels of the organization, with lower levels helping to provide information about and insights into external trends to middle and top managers (Teece and Linden, 2017).

However, MSEs face significant challenges like systemic failures and unintended consequences in building sensing capabilities to predict the latest digitization trends (Chen et al., 2021). Dynamic managerial capabilities and business units dedicated to scenario planning are essential to mitigate such challenges (Ramírez et al., 2013). MSEs further need to build generative sensing capabilities that use technologies to generate and test multiple hypotheses to help managers explain surprising events and judge the impact of unexpected trends (Dong, 2016).

Studies report that MSEs in pursuit of digital innovation require sensing capabilities in digital evolution scanning to gather information through new digital devices, channels, and emerging user behaviors across contexts and markets (Khan et al., 2021). Here, sensing capabilities do not reside exclusively inside firms but can be co-created with other parties in the business ecosystem.

Also, to address opportunities or neutralize threats in COVID-19 era, MSEs require seizing capabilities that ensure managers avoid deception, bias, and delusion and allow MSEs to experiment with digital platforms and new business models. Seizing is an experimental capability that supports action and commitment by using techniques such as rapid prototyping and real options logic to balance risk and reward effectively (Day and Schoemaker, 2016).

Sensing and seizing capabilities help MSEs create and discover opportunities in the COVID-19 period. However, to execute a digitization strategy, MSEs need transforming capabilities to realize the full potential of strategic change (Garbellano and Da Veiga, 2019).

A firm with “transforming capabilities is one where the agile, entrepreneurial mindset is actively cultivated within, with a broad, expansive approach to external network-building as well.” (Day and Schoemaker, 2016). Thus, transforming capabilities supports MSEs with the continuous strategic renewal of assets and organizational structures to ensure responsiveness in fast-changing environments, especially in the COVID-19 era.

Understanding how MSEs build dynamic capabilities for digital transformation is a paramount strategic question that is yet to be fully understood, providing an avenue for further investigation.

Some studies claim that due to the COVID-19 outbreak, enterprises can focus only on exploration or exploitation with a specific preference (Katz et al., 2020). Others argue that it is simpler for larger enterprises to become ambidextrous since they have more significant and more diversified resources (Buliga et al., 2016). Many studies focus on large enterprise ambidexterity but consider MSEs ambidexterity and building dynamic capabilities (Chen et al., 2018). Ambidexterity is a dynamic capability that can enable MSEs to fix COVID-19 issues (Papadopoulos et al., 2020). Investigating this ambidexterity by building joint capabilities across environmental, economic, and social sustainability—and their levels of relationships—due to the adoption of digitization by MSEs are primed for research. Given the potential for digitization adoption post-COVID-19, the sample size of these MSEs is likely to grow, especially in developing countries.

2.6. Transaction cost analysis

Transaction costs theory is an optimal management structure to reduce total costs under exogenous transaction conditions (Schmidt and Wagner, 2019). The theory is well-established within operations and supply chain management and purchasing and supply management. Akbar and Tracogna (2018) used the theory to study the sharing economy and the hotel industry's future.

The transaction is the theory's unit of analysis and is understood as an exchange of information, goods, or services between subsequent stages of a production process (Williamson, 1989). For example, a transaction is any exchange between value-adding stages within a firm and any buyer's purchase (Williamson, 1998). The constant need to gather and process information, draft and negotiate contracts and arrangements, monitor and enforce agreements, and manage and maintain relationships generates transaction costs.

Two key assumptions about human behavior are fundamental to transaction cost theory: bounded rationality and opportunism (Williamson, 1989). First, bounded rationality considers cognitive restrictions when conducting human behavior. An individual might want to act rationally, but the inability to process all available information limits a decision's rationality.

Second, opportunism denotes the risk that the other party seeks self-interest primarily. Opportunistic behavior includes withholding information, cheating, or any other contract violation form.

Three key constructs within transaction cost theory directly influence the transaction costs of economic exchange: asset-specific investments, transaction characteristics, and uncertainty (Dahlstrom and Nygaard, 2010). Transaction cost theory considers two forms of uncertainty to drive costs. Due to potential regulatory, political, or economic changes, environmental uncertainty increases the difficulty to draft sufficient agreements before exchange. Behavioral uncertainty occurs if one party's performance after a transaction is difficult to measure, often due to implicitly or explicitly generated information asymmetry.

Transaction cost theory prescribes governance structures to minimize costs under given exogenous conditions. As the global economy changes and managers increasingly engage in collaborative partnerships, relational governance structures are also integrated into the transaction cost framework (Schmidt and Wagner, 2019). Three distinct transaction governance problems originate from the transaction cost theory. Specifically, organizations have to solve the safeguarding, performance measurement, and adaptation problem by selecting an appropriate governance structure (Leiblein, 2003).

The measurement of transaction costs is based on the assumption that price and its transaction cost decide an organizational undertaking. The most economical transaction is to minimize trans-

action cost and maximizes the price, which is the acceptable transaction mode (Roeck et al., 2020).

Digital technology adoption can simultaneously affect and reduce the costs of MSEs processes and activities. For example, an MSE can stop business with enterprises that can replace digital technology for their services or new market entrants that provide digital services to emerge.

In supply chain digitization investigations, researchers have analyzed transaction costs from the perspective of digital technology. For example, Schmidt and Wagner (2019) explored digital technology's ability to reduce transaction costs. Studies support that the digitization and market-oriented governance structure for buyer-supplier transactions can reduce transaction costs (e.g. Hazen et al., 2016; Sanders et al., 2019). This cost reduction is achieved by limiting opportunistic behavior as well as environmental and behavioral uncertainties. Similarly, Roeck et al. (2020) studied the ability to minimize or even eliminate digital technologies' cost. They identified nine impacts of supply chain transactions conditions of trust, transparency and disintermediation.

Similarly, Rowan and Galanakis (2020) based on transaction cost to review the challenges, opportunities, and potential solutions for digitizing MSEs in the post-COVID-19 period. At the same time, Akbar and Tracogna (2018) showed how digitization for both trading parties could also lower opportunistic behavior in the hotel industry. This is because some digital technology, especially blockchain, records verifiable smart contracts (Saber et al., 2019). In general, the measurement of transaction costs may help assess the effects of changes in transaction costs. Digital technologies impact organizational processes and activities subsequently.

2.7. Technology- organization – environment framework and digital transformation of MSEs

Although other adoption models exist, we employ the Technology-Organisation-Environment (TOE) Framework because of its focus on technological, environmental, and organizational factors that influence MSEs decisions to adopt digital transformation (Wong et al., 2020). TOE offers a more comprehensive view of technology adoption because embracing digital transformation depends on technological, organizational, and environmental factors (Orji et al., 2020).

Kouhizadeh et al. (2021) used TOE to investigate blockchain adoption barriers among academics and practitioners. Relatedly, Orji et al. (2019) developed a theoretical framework based upon TOE for critical success factors, which influence the use of social media for supply chain social sustainability in freight logistics firms in Nigeria.

TOE has been popular in the study of Small and Medium Enterprises (SMEs) technology adoption. Abed (2020) examines the factors that affect SME social commerce adoption using TOE. Their survey of 181 SMEs in Saudi Arabia indicates that trading partner pressure in the environmental context, followed by top management support in the organizational context, and perceived usefulness in the technological context, have the most significant influence on behavioral intention to use social commerce. These dimensions are popular in TOE.

Wong et al. (2020) adopted the TOE Framework to investigate blockchain adoption of 194 SMEs in Malaysia empirically. They found that SMEs often lack technological investments but face the same requirements for streamlining business processes to optimize returns. Blockchain presents a viable option for SME sustainability due to its immutability, transparency, and security potential to revolutionize businesses which is also supported by Orji et al. (2020).

TOE can help predict digital transformation in MSEs (Bollweg et al., 2016; Rahayu and Day, 2015). This TOE capability is because different innovations have different adoption

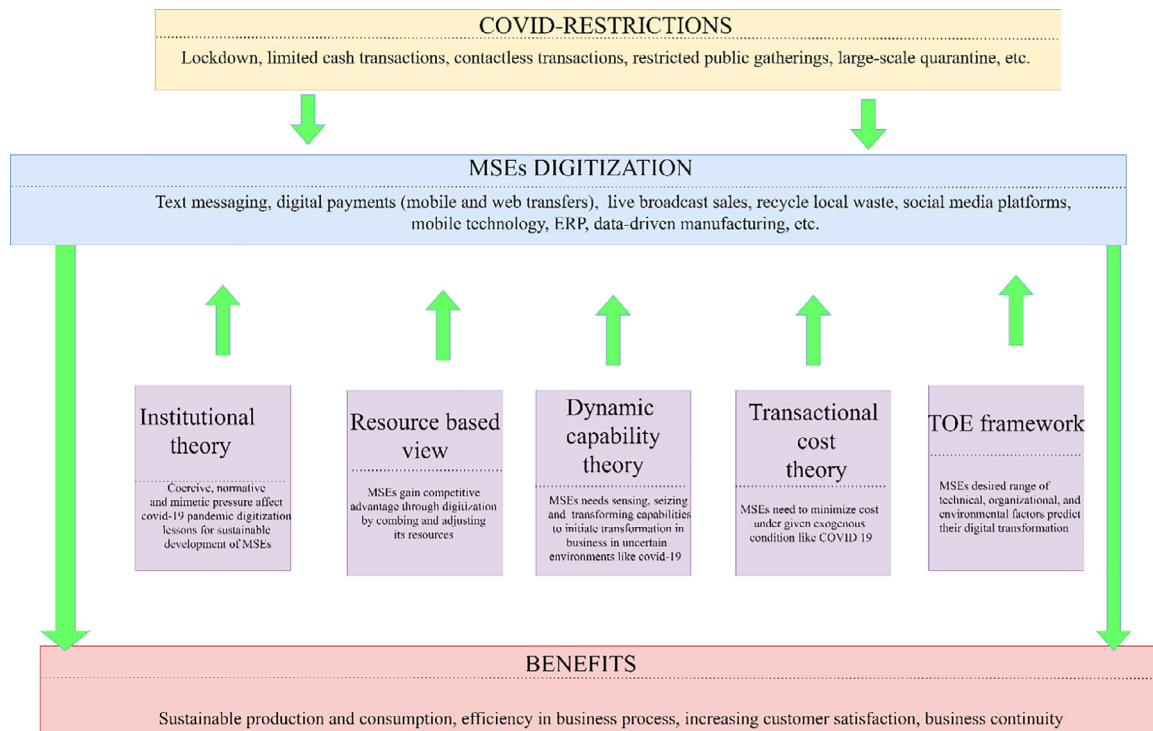


Fig. 2. A framework to support COVID-19 Pandemic Digitization Lessons for Sustainable Development of MSEs.

factors in different cultures and contexts, such as MSEs, especially in developing economies. The argument is that MSEs have technological, organizational, and environmental factors that differ from SMEs and large-sized firms (Sohns and Revilla Diez, 2018). For example, in Ghana, specific government institutions and policies support micro and small enterprises' capacity due to their unique nature (Oppong et al., 2014). There have also been fiscal incentives, grants, bilateral and aids from multilateral agencies, and specialized institutions supporting MSE success."

In summary, we believe the organizational theories discussed in this section have reference value for further studies on the potential research fields provided by this paper. They underpin MSEs digitization, especially in the COVID-19 period, to enhance sustainable production and consumption, and business continuity. We develop a conceptual framework that summarizes how these theories support COVID-19 pandemic digitization lessons for sustainable development of MSEs in Fig. 2 below.

3. Implications for practice

MSEs digitization should be of importance for multiple organizations across the supply chain and policy-makers. One critical aspect of this digital transformation is to enhance sustainable production and consumption. Clearly, resource constrained MSEs will require appropriate systems and support staff that can be enhanced through improved public and supply chain supported infrastructure. This infrastructure is necessary to ensure effective business operations and integration within and between organizations. For example, policymakers can help establish a multi-agency platform to support MSEs access digital technologies; with special focus on monitoring environmental and social performance. They can also provide training and support in using e-commerce and social commerce, digital payments, and alternate modes of financing—including those from the private sector—this can socially enhance these vulnerable organizations.

These supportive developments would enhance economic well-being, which is a strong social sustainability effort, but also make operations more efficient reducing waste and sharing information related to latest practices for environmental and social sustainability.

Post-COVID-19, MSEs would need to rethink strategies to incorporate crisis scenarios and business continuity plans using alternative additional sale channels. Sustaining customers virtually is not an easy task as providing a substandard service will harm companies irreversibly.

COVID-19 resulted in MSEs facing greater challenges and uncertainties; organizational actors need to build greater adaptability through digitization. Scenario building with digitalization included from lessons learned can provide managers to more effectively determine whether they have adaptable and dynamic capabilities. These experiences can be parlayed to more effectively address future longer-term issues that may arise from environmental and social sustainability crises. The concern here is that MSEs do not necessarily have this longer term and adaptable focus—COVID-19 may have provided them opportunity to consider these, even given the short-term challenges faced.

A stakeholder approach has been theorized for organizational social and environmental sustainability management. MSEs need to carefully examine how crises affect broader stakeholders outside organizational boundaries and their communities. An integrated approach to improve local, national, and global community environments is one lesson learned in this environment. The pandemic crisis showed MSEs organization leaders that stakeholder complexity will also result in multi-faceted decisions. That the well-being of organizations, and their approach to sustainable production and consumption is not only based on decisions they make but are greatly affected by issues and concerns outside the traditional supply chain and organizational boundaries. Digitization can allow them to be integrated with these communities, social and environmental sustainability concerns.

The use of digitization in extreme disruptions may help people and organizations stay connected, facilitate smart working situation, and links to potential stakeholder privacy infringements. Practitioners should need to carefully consider how digitization changes the MSEs modes of working—not only for MSE's themselves, but partners. Implications for sustainable development include the issues of community building, knowledge sharing and organizational learning all related to various social and environmental concerns. Digital transformation for MSEs that supported business continuity during COVID-19 need to be evaluated from social and environmental sustainability dimensions. Example social sustainability may be safety and health issues can be managed more effectively—workers can reply and do work from home if there are emergency situations. Yet, care must be taken that these situations do not exploit workers who might be continuously on call. More broadly, policy makers need to consider whether greater digitization is good for the environment, especially given some of the energy requirements of these systems.

The transformational initiatives of MSEs during the COVID-19 disruption slightly shifted from technology to social, customer, and organizational driven changes. The choice of technology could be related to the MSE's existing equipment, basic digital competencies to use these technologies, and already established digital communication channels with customers. Lack of resources and expertise connected to the use of more advanced technological solutions could also play a role. This emergent role should be taken into account by policy-makers when defining new policies relating to future MSEs support measures, especially when those measures are to help govern various sustainability—environmental and social goals.

Innovation challenges that arise from including digital technologies such as AI (artificial intelligence) in developing sustainable business models are likely to have ethical, social, economic, and legal implications. In this context, the collaboration of scholars, professionals, and institutions in continuing research and implementing a public-private partnership network to anticipate and manage the profound social changes connected to the digital revolution are needed to support sustainability.

Innovation in creating sustainable business models for delivering services, remote operations, substitution and channels of service delivery, innovative collaboration environments, and new service consumption opportunities enable and improve the value proposition. MSEs often need external inputs and resources on these matters.

The influence of COVID-19 motivates MSEs to rethink their core competencies, seek new opportunities, and redefine sustainable business models in a more intense and timely manner. Strategic ambidexterity in shorter cycles, balancing between measures, and concentrating on building innovation is not limited to only MSEs during this period. Developing new competencies, improving expertise, and enhancing professional experience regarding applying new technologies within business models is a significant regional development need over the long-term. MSEs can survive this and other disruptions, and in this example will emerge capable of adopting new technologies and become more competitive.

4. Research implications and future directions

Given the possibilities and the uncertainties associated with digitization technology, much of what we are proposing is based on newer technologies and evolving settings; some of which are unprecedented. We now introduce additional outstanding and potential research questions that require further study.

- 1 How will digital innovations diffuse through the supply chain to benefit MSEs? Will digital innovations result in im-

proved MSEs sustainability performance and contribution to supply chain sustainability?

- 2 What cultural and socioeconomic challenges exist for MSEs technology acceptance behavior? The adoption of new technologies may be met with some suspicion. Will environmental sustainability—for example recycling electronics—in sustainable and circular economy improvements from digitization bring corresponding economic improvement to informal partners?
- 3 Do traditional technology acceptance theory frameworks and models apply in this emerging economy supply chain environment; especially during and after similar crises? Will crises overcome the mistrust and cost of these digital technologies and alter their adoption?
- 4 Can multi-stakeholder environmental regulatory policy more effectively include MSEs, especially informal MSEs, through digitization?
- 5 What is the relationship between the capacity of MSEs and environmental regulation? Do COVID-19 style mechanisms and regulations, such as stimulus funds and distribution, provide additional avenues for MSEs to be more sustainable actors?
- 6 What roles do various stakeholders and institutions play in the digital inclusion of MSEs? For instance, NGOs, governments, and local community stakeholder involvement. Have collaborations amongst these broad sets of stakeholders occurred during the COVID-19 crisis, will they be maintained, and can lessons be learned?
- 7 How does digital transformation change the customer value creation process for MSEs? What are the most important dynamic capabilities for digital transformation in MSEs; especially with relation to sustainable production and consumption?
- 8 Should MSEs pursue digitization alignment during COVID-19 and similar crises? Does a direct link between digitization and performance during COVID-19 exist and what can be learned for broader sustainability?
- 9 What skills and training—human resource capabilities—do MSEs require for digitization? How can policymakers promote MSEs training programs—with digitization—to achieve inclusive environmentally sustainable practices?
- 10 How do cloud-systems, artificial intelligence (AI), e-commerce, analytics, social media, and the sharing economy and their synergistic relationships, create sustainability opportunities for MSEs?
- 11 What challenges do MSEs face in participating in digital ecosystems; especially with relationships to environmental and social sustainability?

5. Conclusion

This paper sheds light on digitization lessons that can be gleaned for MSEs to build resilient and sustainable post-COVID-19 supply chains—especially vulnerable MSEs populations in developing countries. We believe MSEs digitization is feasible; this is especially true for many agrarian-based developing countries like Ghana in sub-Saharan Africa. Emerging economies in environmentally sensitive regions of the world—such as Brazil and Indonesia are also exemplary locations that have the potential to leap-frog technological inclusion for the sustainability of their MSEs. Not only do practical issues and exemplars exist to achieve sustainability through digitization in a post-COVID-19 world, but research can be advanced from some basic questions addressed in this perspective paper. For example, we provided theoretical lenses that can help investigate and may even support MSEs digital transformation processes, especially for circular, economical, sustainable sup-

ply chain, and sustainable consumption and production improvements.

However, we acknowledge that this digital transformation for sustainability will meet some challenges. First, there are concerns with digital innovation diffusion through MSEs supply chains that can benefit them. MSEs digital transformation for sustainability requires the support of external stakeholders; including government, supply chain partners, and communities. Second, and relatedly, the roles of various stakeholders and institutions are complex and ambiguous. Should support be through private or public or hybrid means? Does this support lead to free-market economic concerns and issues on a global scale. Third, various industrial requirements can hamper or support these initiatives, the knowledge, expertise, and diffusion of digitization across industries is, at best, uneven. In some cases, those who have something to lose will likely put up various barriers to the diffusion of such technologies. Managing these barriers will not be easy for vulnerable and resource-deprived MSEs, especially when stimulus packages become competitive.

We provide some of these concerns as further research areas to enhance the successful digital transformation of MSE's post COVID-19.

We strongly believe this environment and context, for at least the next few years, is an opportunity for MSEs in developing countries to become environmentally and socially sustainable while contributing to economic recovery in these regions. Digitization is an important enabler in this context.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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