Interactive Components of Digital MSMEs Ecosystem for Inclusive Digital Economy in Indonesia

Erman Aminullah1 · Trina Fizzanty1 · Nawawi Nawawi2 · Joko Suryanto1 · Nika Pranata1 · Ikbal Maulana3 · Luthfina Ariyani4 · Adityo Wicaksono4 · Ikval Suardi1 · Nyimas Latifah Letty Azis5 · Aisah Putri Budiatri5

Received: 10 July 2021 / Accepted: 23 September 2022 © The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2022

Abstract
The study examined the interactive components of digital micro and small medium enterprise (MSMEs) ecosystem for inclusive digital economy, more specifically found ways to put the digital MSMEs ecosystem to work for accelerating the MSMEs digitalization. The multiple cases studies’ findings and discussion supported the model building. The model of digital MSMEs ecosystem was formulated as the surrounding interactive components of ecosystem, enabling digital MSMEs to realize and accelerate toward the digital economy. The novelty of model represented the reality of digital MSMEs ecosystem in Indonesia. There were three main constraints of digital MSMEs ecosystem to work: (i) human capital in digital talent, (ii) socio-technical adaptation, and (iii) government support for MSMEs going digital. Putting the digital MSMEs ecosystem to work needs three ecosystem resolutions: (i) building the MSMEs human capital in digital talent; (ii) acceleration of socio-technical adaptation to the digital application; and (iii) the sustainability of existing government support for MSMEs going digital to create inclusive digital economy. The recommendation for three digital MSMEs ecosystem resolutions needs to consider sectoral and regional characteristics in practices.

Keywords Digital economy · Digital MSMEs ecosystem · Digital MSMEs ecosystem model · Digital ecosystem constraints · Digital ecosystem resolution

¢ Erman Aminullah
aminullahe@yahoo.com

Extended author information available on the last page of the article

Published online: 12 November 2022
Introduction

Background and Objective

Micro and small medium enterprise (MSMEs) is an essential component of Indonesia’s economy. The MSMEs, including micro-business, build up 99% of total businesses in the country and significantly contribute to the creation of jobs (Capri, 2019). Until 2018, the MSMEs population had reached 64 million and created 117 million jobs (Ministry of Cooperation and SME, 2020). Majority of those SMEs are starting to experience a digital transformation journey in response to market demand (Deloitte, 2021). Although the digital ecosystem was booming, marked by the rapid growth of digital marketplaces (Tokopedia, Shopee, Bukalapak, Lazada, and Blibli), however, the adoption of digital technology by MSMEs is still low. Among 64 million MSMEs, only 8 million (12.5%) have onboarded into online businesses and used digital technology (Wantiknas, 2020a).

The digitalization of MSMEs has intensified since the COVID-19 pandemic. The MSMEs response to adapt with COVID-19 through digital transformation reflected the MSMEs organizational resilience (Klein & Todesco, 2021). Various responses emerged: stay with conventional business, switch to online selling, join existing business platforms, or create their own digital platforms to meet the digital demand. At least three categories of digital business have accelerated with the digital consumers’ influx, namely education, retail, and loans. The massive changes toward the digital economy have pushed the evolution of Indonesia’s digital ecosystem. Thus, it demanded the MSMEs adaptation efforts to survive and grab the digital opportunity. Onboarding into the digital transformation would become the key to resiliency during and post-pandemic era (Crupi et al., 2020).

The digitalization of MSMEs has been widely documented in the literature. The previous research results on MSMEs digitalization were generally related to (i) managing the digitalization process of SMEs from conventional to digital-based business transactions (Dahbi & Benmoussa, 2019; Kaarianen et al., 2020; Savrula et al., 2014; Sin et al., 2016; Szopa & Cyplik, 2020); (ii) the application of internet technology for commercial transactions, business processes, and production (Garzoni et al., 2020; Kabanda & Brown, 2017; Sarosa, 2012; Sen et al., 2016; Ulas, 2019); and (iii) SMEs going global through digital platforms (Ganne & Lundquist, 2019; Moertini, 2012; Ueasangkomsate, 2015).

Although plenty of academic sources on the digitalization of SMEs, however, by far, we could not find literature related to digital MSMEs ecosystem, such a knowledge gap would be filled by this study. This would become the novelty of this study. The digital MSMEs ecosystem here is defined as the surrounding interactive components, which enable digital MSMEs to realize and accelerate toward the digital economy (see literature review). The objective of study is to investigate the interactive components of digital MSMEs ecosystem for inclusive digital economy viewed from a policy perspective, by which the results of the study will contribute to realize and accelerate MSMEs digitalization in Indonesia.
The specific question of the study is how to put the digital MSMEs ecosystem to work for accelerating the MSMEs digitalization in Indonesia? The questions are the following: (i) What and how model of digital MSMEs ecosystem that works is? (ii) What constraints of digital MSMEs ecosystem to work are? (iii) What resolutions for putting the digital MSMEs ecosystem to work? (iv) What scientific and practical contributions of this digital MSMEs ecosystem study are?

Multiple Case Studies

This study was conducted through a multiple case studies approach by the following reasons: (i) the subject of study on ecosystem contains complexity and contextual conditions (Yin, 2014); (ii) the multiple case studies can strengthen the grounding of theory building (Eisenhardt, 1989); and (iii) the multiple case study results are likely to generate novel concepts. This research involved a total of 26 MSMEs’ cases from three regions in Indonesia, i.e., West Sumatra, West Java, and Yogyakarta. The region selection represented the distribution of MSMEs population by regions. The selected MSME firms satisfy three criteria: (i) meeting the MSME criteria stipulated by the government regulation, specifically in terms of total assets and sales turnover, (ii) encompassing the two sectors, namely, food and fashion sectors as the dominant sectors in three regions, and (iii) covering the different levels of digitalization, i.e., conventional, e-commerce, e-business, and industry 4.0.

The data collection method was semi-structured interviews and focus group discussions with MSME owners, pertaining to (i) the MSMEs profile and market performance, (ii) the digitalization level and the dynamics of the transformation process, and (iii) the enabler and inhibiting factors during the transformation process. Face to face interviews with MSMEs owner and entrepreneurs were conducted for 2 h on average, recorded, and the transcriptions were done. The collected data from multiple case studies was categorized into three regional profile data.

The Regional Profile Data

First, West Sumatra region. Nine MSMEs were studied comprising the food and fashion industry, furniture industry, and a local marketplace initiated by an academician from a local university and run by young entrepreneurs. The profile of MSMEs digitalization in West Sumatra is summarized in Appendix Table 4. General characteristic of West Sumatra’s MSMEs emphasizes more on individual competition rather than business collaboration.

Second, West Java region. Eight MSMEs were studied, mainly composing fashion commodities and one food commodity representing the MSMEs going digital in West Java. The profile of MSMEs digitalization in West Java is summarized in Appendix Table 5. General characteristic of West Java’s MSMEs is more adaptive to upgrade technology capability and increase in production capacity.

Third, Yogyakarta region. Nine MSMEs were studied, mainly from food commodities, one fashion commodity, and two crafts representing the MSMEs going digital in Yogyakarta. The profile of MSMEs digitalization in Yogyakarta is
summarized in Appendix Table 6. General characteristic of Yogyakarta’s MSMEs is occasionally influenced by the social habits of “nrimo” (in local term), namely being satisfied with what has been obtained without having to struggle very hard to find what has not been obtained.

Data Analysis

The data from the case study were categorized into six components of the digital MSMEs ecosystem: (i) digital SMEs market, (ii) human capital, (iii) innovation, (iv) socio-technical adaptation, (v) digital financing, and (vi) government role. Furthermore, the findings were elaborated by sector and by region. The discussion on the findings was done by using the conceptual model of digital MSMEs ecosystem. Then, the conclusion was drawn from the discussion.

Literature Review

Ecosystem

An ecosystem is the interaction between components or actors in equilibrium within the as if borderless of the system and its ecology or environment. It is the interaction of whole components surrounding the ecosystem. The definition based on Golley (1993:167–205) on the history of ecosystem concept. The actors involved in ecosystem work at local, national, and global levels. There are several types of ecosystem, including industrial ecosystem, innovation ecosystem, business ecosystem, entrepreneurship ecosystem, digital ecosystem, and global ecosystem (Harland & Whitmore, 2007; Pilinkiene & Maciulis, 2014).

Ecosystem Perspective

The ecosystem can be seen from four interrelated perspectives: (i) industrial ecology perspective based on industrial ecosystems, the company as the main actor to realize industrial system sustainability; (ii) business ecosystem perspective based on organizational theory, collaborative private companies as main actors to realize common objectives; (iii) platform ecosystem perspective that departs from management theory, with companies and consumers as the main actors to collaborate in the platform; and (iv) multi-actor network perspective is based on social network theory, government agencies, private companies, and consumers as main actors to establish multi actors’ relationships (Tsujimoto et al., 2018). Understanding these interrelated perspectives and interactive actors, ecosystem research requires a cross-disciplinary team (Major, 1969).
Ecosystem Models

The model can be differentiated by (i) customer participation model. Under the customer-driven business ecosystem, the view of customers has changed from a passive buyer to an active participant, who behaves as partner-producer or partner-value creation in the ecosystem (Joo & Shin, 2018); (ii) business value chain model. The values-driven business ecosystem consists of four elements of the value chain, namely end-user value, business value, collaborative value, and social value where a reliable business model as the goal of a company (Leviakangas & Oorni, 2020); (iii) business environment model. This ecosystem is composed of four interrelated components: actors, main business ecosystem, the business sector, and socio-economic dimension of technology. Actors and their activities are lower layer components that are conditioned by components in the upper layers (Moller et al., 2020); (iv) digital economy model. The digital economy ecosystem constitutes four interdependent sub-ecosystems: the business ecosystem, the consumer ecosystem, the ecosystem of talent and innovation, and the ecosystem of digital platforms and communications (Karpunina et al., 2020).

Model of Digital MSMEs Ecosystem

The model of sector’s digital economy ecosystem, focusing on MSMEs sector, was constructed. The model represents the relevance problems on how the Indonesian MSMEs ecosystem going digital. The initial model was viewed from multi perspectives, it was developed from extensive literature review, and originally consisting of five interrelated components, namely economy, socio-technical system, governance, human resources, and innovation by digital. Each component consists of several elements that interact with each other in the complex ecosystem. All actors in every component and element of the ecosystem have an equally important position as an enabler in realizing the SME digital economy. The iteration process was carried out to refine the initial model based on information cross-check (triangulation) with the owners of MSMEs under studies. The cross-check was also complemented by feedbacks from several workshops with relevant stakeholders, namely MSMEs business association, central and local government institutions dealing with MSMEs, financial institutions, and digital providers. The construction of final model reflecting the Indonesian MSMEs reality is viewed from a policy perspective composing of six components. For the steps of iteration process, it is depicted in Appendix Fig. 2.

The digital MSMEs ecosystem here is defined as the surrounding interactive components of ecosystem, enabling digital MSMEs to realize and accelerate toward the digital economy. The model comprises six components as a continuing process of building a digital MSMEs ecosystem. Putting the model to work is creating a digital MSMEs market as the main objective, through continuously positive feedback interaction between six components, controlled by the regular government role. The model uses policy perspective, where the government role is central. Other possible components beyond the six components of model are excluded. See Fig. 1.
Digital MSMEs Market

The acceleration of digital transformation for MSMEs should be under the role of government as (i) enabler to facilitate MSMEs for an inclusive digital economy development and (ii) controller to oversee institutions dealing with the inclusive digital economy (Bachtiar et al., 2020). Digital transformation should elevate SMEs moving up from local, national to global market players. The MSMEs’ lack of knowledge about the marketplace and the ability to look over the market opportunities in digital media needs an integrated training system by mixing mentorship, access to financing and marketing (Ningsih et al., 2019). It becomes the basis for MSMEs moving up to global e-commerce, where upgrading the SME capabilities that underlie global e-commerce development are (i) marketing-based capabilities including the ability to develop a new market offering, ability to reach and process customer knowledge, and skill development; and (ii) digital business capability (Tolstoy et al., 2020).

Human Capital’s Continuous Learning for Innovation

Major problems of human capital are (i) the owners/managers of MSMEs are not familiar with digital technology in MSMEs, and (ii) lack of skills and knowledge, both in management and business operation, lead to the generation of barriers to digital technology adoption (Martin et al., 2013). The differentiation of ICT adoption, skill, and use in MSMEs are determined by the age and education level of
human capital (Kusumaningtyas & Suwarto, 2015). Digital transformation depends on MSME entrepreneurs’ capability (Li et al., 2018). A critical challenge faced by MSME’s leaders, as a consequence of the continuing digital technology revolution, is to optimally align business strategy with digital technology to fully leverage the potential offered by these technologies in pursuit of longevity and growth (Li et al., 2016). Human factor facilitates innovation in digitalized MSMEs through customer-orientated digital service capabilities enable value co-creation (Saunila et al., 2019). MSME leaders need to support continuous learning about the properties of digital technologies for innovation, which entailing the more flexible time, place, work tasks, and social interaction (Yanuardani, 2018).

### Innovation Through Digital Ecosystem

MSMEs needed to be innovative to compete, but it is not sufficient. Product, process, and organizational innovations alone are no longer sufficient for MSMEs to survive and thrive. The greatest strength now is innovation through digital ecosystems: creating added value through partnerships. Currently, there is a new business model and the rules of the game are made together with partners and stakeholders, namely MSMEs, industry’s/MSMEs service partners, suppliers, customers, government, non-governmental organizations, and city governments. MSMEs can develop from a tiny company; then, they can grow into a platform through digitalization, creating an ecosystem. In the platform, all elements collaborate in interdependence and work together in competition to grow together. This business innovation-based digital ecosystem is characterized by high complexity, interdependence, cooperation, competition, and mutual evolution (Gay & Szostak, 2019).

### Socio-Technical Adaptation Induced by Digital Technology Application

Digital technology application will increase the SMEs reputation from the eyes of their customers. The better the reputation of SMEs, the more they encourage SMEs to develop platforms. Creating a platform will encourage a collaborative economy, shifting from competition to coalitions between companies and forming a partnership in the business platform (Gay & Szostak, 2019). Digital technology application calls for digital transformation in society, where humans are re-shaping the way society works, including patterns for information and communication (Norqvist, 2018). Staying at home during COVID-19 has the effects for social habits to use online trading and buying retail e-commerce and SMEs, which is driven by institutional support and demand change (Dannenberg et al., 2020). Seeing from the socio-economic angle, digital technology application emphasizes the complementarity between technological transformation and social adaptiveness (Strohmaier et al., 2019). In the broader context, whether the focus is technology, economic, and society, the digital society implies technically growing reliance on electricity in supporting socio-economic development (Hasna, 2009).
Digital Financing to Promote MSMEs

The development of inclusive digital finance can significantly ease the financing constraints of MSMEs. Digital finance provides full play to the advantages of “low cost, fast speed and wide coverage” through scenes and data to reduce the financial service threshold and service cost, improve MSMEs’ financing environment, and serve inclusive financial subjects (Huang, 2019). Digitalization is a leading enabler of MSMEs finance, where SMEs can use software solutions and tools to transform their businesses digitally. Key technologies transform financial services and impact MSMEs finance. New digital financial products such as FinTechs, BigTech companies, and other financial institutions offer MSMEs and individuals. The digital MSMEs financial services as a response to pandemic include the following: (i) digital payments include payments initiated by debit or credit card, mobile phone, computer, tablet, or wearable digital device; (ii) digital lending advances in technology make it possible to digitalize different types of credit products and offer them to SMEs in a faster, more convenient, and sometimes cheaper way than through traditional methods (IBRD/World Bank, 2020).

Government Role for Digital MSMEs

There are various roles the state can act in developing the digital economy. The general roles are as follows: (i) setting new policies for the digital age and aligning digital initiatives with national development strategy, (ii) investing in human and organizational complements and institutional learning across all sectors to secure digital dividends and inclusion, (iii) supporting R&D and innovation and playing an entrepreneurial role in researching and testing promising new digital platforms and technologies, and (iv) extending the backbone telecommunications infrastructure and securing access to an inclusive and affordable internet. The specific roles of nurturing a digital transformation ecosystem are as follows: (i) promote the effective supply and use of ICT in all sectors of the economy, especially ICT use and linkage for export orientation, (ii) upgrade skilled human in digital literacy, digital application, and data entrepreneurship, (iii) provide grassroots and demand-driven innovation funds, which support the use of ICT for socially driven and bottom-up innovation to improve the local SMEs performance and local people, (iv) provide affordable access to the Internet and ICT tools and promote societal trust in the use of ICT tools, and (v) facilitate access to digital financing for building an inclusive digital economy (Hanna, 2018).

Multiple Case Studies’ Results

Component of Digital MSMEs Ecosystem at Firms Level

The six components of digital MSMEs ecosystem at firms level are depicted in Table 1.
| No | Firm | Digital MSMEs market | Human capital | Innovation | Socio-technical adaptation | Digital financing | Government role |
|----|------|----------------------|--------------|------------|--------------------------|------------------|-----------------|
| 1  | ZS   | Overseas             | Average workers’ digital skill | Create simply new product variances | Follow digital training | Combine cash and bank transfer | Digital training, exhibition |
| 2  | BM   | Overseas, increase by digital | Average worker’s digital skill | Improve product quality | Reluctance to learn digital | Combine cash and bank transfer | No training attended |
| 3  | TL   | National, stable by digital | Moderate workers’ digital skill | Improve product features | Use digital application | Combine cash and bank transfer | Exhibition, promotion support |
| 4  | AF   | Province, increase by digital | High workers’ digital skill | Create simply new product variances | Use digital application | Combine cash and bank transfer | No training attended |
| 5  | DC   | National, increase by digital | Moderate workers’ digital skill | Create simply new product variances | Use digital application | Combine cash and bank transfer | No training attended |
| 6  | KM   | National, stable by digital | Moderate workers’ digital skill | Create simply new product variances | Use digital application | Combine cash and bank transfer | Training and mentoring, funding support |
| 7  | LE   | Local                | Low workers’ digital skill | Create simply new product variances | reluctance to learn digital | Cash only | Business management training |
| 8  | CH   | National             | High workers’ digital skill | Improve production process | Use digital application | Cash only and bank transfer | Overseas exhibition, export information |
| 9  | KE   | Local                | Moderate workers’ digital skill | Improve product quality | Promote digital application | Combine cash-online transaction | Entrepreneurship training |
| 10 | SR   | National             | Average workers’ digital skill | Improve production process | Use digital application | Combine cash and bank transfer | Technical training |
| 11 | SO   | National, stable by digital | Moderate workers’ digital skill | Improve product features | Use digital application | Combine cash-online transaction | Technical training |
| 12 | KB   | National             | Average workers’ digital skill | Create simply new product variance | Reluctance to learn digital | Cash only | No training attended |
| 13 | RC   | National, stable by digital | Moderate workers’ digital skill | Improve product features | Use digital application | Combine cash and bank transfer | Technical training, exhibition |
### Table 1 (continued)

| No | Firm | Component of ecosystem | Digital MSMEs market | Human capital | Innovation | Socio-technical adaptation | Digital financing | Government role |
|----|------|------------------------|----------------------|--------------|------------|-----------------------------|------------------|----------------|
| 14 | SH   | National, stable by digital | Moderate workers’ digital skill | Improve production process | Use digital application | Combine cash and bank transfer | Exhibition |
| 15 | OS   | National | Average workers’ digital skill | Create simply new product variances | Reluctance to learn digital | Cash only | No training attended |
| 16 | MT   | National | High workers’ digital skill | Improve product features and distribution | Use digital application | Combine cash-online transaction | No training attended |
| 17 | WK   | National | High workers’ digital skill | Improve product features and distribution | Use digital application | Combine cash-online transaction | Technical training, mentoring |
| 18 | GJ   | National, increase by digital | Moderate workers’ digital skill | Improve product features, quality, and production | Use digital application | Combine cash and bank transfer | Technical and digital training, promotions, funding support |
| 19 | BS   | Local, increase by digital | Moderate workers’ digital skill | Create simply new product variances | Use digital application | Combine cash-online transaction | Technical training, exhibition |
| 20 | LH   | Local | Average workers’ digital skill | Create simply new product variances | Follow digital training | Cash only | Business management training |
| 21 | SK   | Local | Average workers’ digital skill | Create simply new product variances | Reluctance to learn digital | Combine cash and bank transfer | Technical training, exhibition, procurement |
| 22 | IP   | Local | Average workers’ digital skill | Create simply new product variances | Reluctance to learn digital | Combine cash and bank transfer | Technical training, exhibition, production facility |
| 23 | KS   | Local | Below average workers’ digital skill | Create simply new product variances | Reluctance to learn digital | Cash only | No training attended |
| 24 | SP   | National | High workers’ digital skill | Improve product features, quality, and production | Promote digital application | Combine cash-online transaction | Necessary permits and certification supports |
| No | Firm | Digital MSMEs market | Human capital | Innovation | Socio-technical adaptation | Digital financing | Government role |
|----|------|----------------------|---------------|------------|--------------------------|-----------------|-----------------|
| 25 | BL   | National             | Moderate workers’ digital skill | Improve marketing | Reluctance to learn digital | Combine cash and bank transfer | Exhibition       |
| 26 | BB   | International and national | Moderate workers’ digital skill | Improve product features | Use digital application | Combine cash-online transaction | Digital training, exhibition (national & overseas) |

Note on categories order:
- Workers’ digital Skill: high, moderate, average, below average
- Socio-technical adaptation: un-trusted to digital, reluctance to learn digital, follow digital training, use digital application, promote digital application
Digital MSMEs Market

The case studies show that most MSMEs have the capability to serve the national market or even the international market. However, MSMEs market to overseas generally does not follow formal export channels, meanwhile using informal channels such as personal networks (Indonesian diaspora or local visitors) and government promotion program (exhibitions). It indicates MSMEs capability in meeting export requirements, such as international standard and export regulations, were still low. Pandemic COVID-19 has challenged MSMEs to accelerate their digital market. However, it requires certain capital investment, human skills, and also changing business models, as described in the following sections.

Human Capital

Most MSMEs already hold basic digital literacy as they understand the importance of using digital technology for their business and how to use it for the primary function. The successful MSMEs demonstrate more preparedness to build and seek opportunities to enhance their capabilities actively. They participate in plenty of training activities from the government and others such as corporations or foundations. They also upgrade their digital strategy regularly, through training on digital platforms, hiring IT professionals to build their own websites, or investing in digital equipment. The rapid development of MSMEs technical production capabilities is shown by those who pursue intense development programs and actively develop their expertise by participating in technical training programs and collaborating with various stakeholders.

Innovation

Most MSMEs have a low level of innovativeness in their business. They are only capable of occasionally creating new product variances. Meanwhile, several firms can partially improve their product features or product quality. Among these MSMEs, there are at least five MSMEs that stand out in terms of innovation. Two of them, such as MT and WK (from West Java), can be acknowledged as a modern digital business with a brokerage model that connected producer and buyer through their offline and online channels. These two firms have improved the traditional supply chain connectivity. In addition, MSMEs also acquired capabilities to improve their product features, quality, and production process through collaboration with a research institute and/or university.

Socio Technical Adaptation

For MSMEs with limited knowledge and resources, there are various MSME responses to digital technology: (i) Some have been trained to use the application, such as social media, digital platform, or even digital production; (ii) Some of them use digital applications to link with customers and potential customers to improve their production capacity; (iii) Some were reluctant to apply the digital application.
because of high investment, the requirement of a particular skill and dedicated human resources, fierce competition, a new business model, and other considerations such as misuse of technology, fraud, and copyright; (iv) A few of them promote the use of digital technology, particularly for MSMEs with business in digital service and development. The MSMEs in IT business developers would provide training and assistance for other MSMEs in terms of digital skills, production, and market improvement; and (v) Most customers were having low digital literacy, and some of them were not trusted if buying products without having physical contact with the products such as fashion products or prime products (high price).

Digital Financing

Most of the MSMEs that have not implemented modern digital financing (e-loan) and payment (such as mobile banking, Go-pay, Ovo, and Shopee pay). The majority of them are utilizing cash and banking service payments (such as transfer and debit). The SMEs connected to e-commerce platforms automatically use the electronic payment system, but the payment system is not connected to their internal account system. Seven firms can utilize modern digital payment. They can catch up with digital technology through various ways, such as (i) self-learning and participating in various training, (ii) involving the younger generation in the family who has sufficient digital literacy, (iii) hiring dedicated employees; and (iv) assisted by online platforms and/or banks.

Government Role

Most MSMEs appreciated the government’s role in facilitating training and exhibitions. The training is related to technical capacity building to support the core business process (e.g., sewing and crafting). Other training are related to digital literacy and managerial capability improvement. Many MSMEs have acquired several benefits from these facilities, such as improved production capability, production capacity, and sales. However, the challenges of government role in supporting or facilitating MSMEs were still high, such as program discontinuity, minor beneficiaries, and program suitability to MSMEs. As a consequence, some programs sometimes were less effective in supporting MSMEs.

Component of Digital MSMEs Ecosystem by Sector

The component of digital MSMEs ecosystem by two sectors: food and fashion are depicted in Table 2.

Food

All components of MSMEs ecosystem worked in different levels: (i) MSMEs digital market; companies are benefitting from their resellers’ capability to utilize digital technology for accessing the digital market. The critical issue in the food sector
| Ecosystem component | State of digitalization by sector |
|---------------------|----------------------------------|
| **Food**            | **Fashion**                      |
| **Digital MSMEs market** | - The majority of MSMEs served local market, and some of them also distributed to other provinces, and very few also served international market particularly dried food or processed food  
  - Having good partnership with logistics providers, able to meet quality and packaging standard are also factors behind this digital transaction  
  - The international market opportunity is coming from informal network with Indonesian diasphore and also promotion support from government  
  - Local and national customers were dominated market for MSMEs fashion  
  - International customers are occasionally during attending international exhibitions  
  - Connecting to digital market, or applying digital production have opened opportunity for MSMEs to expand their market in fashion sector  
| **Human capital**   | - Most MSMEs have moderate level of digital skill, while some of them possess either average or high level of digital skill  
  - The development of production capability relies on SME’s own initiatives  
  - Endorsement on sustainability and health issue rise in this sector  
  - Most MSMEs have moderate level of digital skill, while some of them possess either average or high level of digital skill  
  - The development of production capability relies not only on MSMEs’ initiatives but also on the co-creation process between MSMEs and their customers  
  - The sustainability issue is less of a concern for m fashion sector  |
| **Innovation**      | - Most of firms show a low level of innovativeness by creating simply product variances; only a few of them able to improve their product features and quality, also production processes  
  - Some of them show moderate level of innovativeness by continuous developing new design to be able to compete in competitive fashion market  
  - Some of them trusted on physical contact in business transaction particularly for prime products and meeting unique customers demand  |
| **Socio-technical adaptation** | - The majority of Food MSMEs are interested in digital market  
  - Some of them have participated in digital training provided by government, or digital providers, or academia  
  - Some MSMEs used the digital in market  
  - Reluctance to apply the digital application for transaction and Refuse to use digital in business. Some reasons are MSMEs digital skills, high investment and staff requirement, and requires new business model  
  - Most MSMEs fashion sector were interested and have utilized digital application in transaction  
  - A few of them applied digital business and production automation  
  - Some MSMEs still reluctance to apply digital, partly due to skill and new business model requirement  
  - Some believe digital market is risky to their product due to copyright issue, fraud, and fierce competition  
  - Some of them trusted on physical contact in business transaction particularly for prime products and meeting unique customers demand  |
### Table 2 (continued)

| Ecosystem component | State of digitalization by sector |
|---------------------|----------------------------------|
|                     | Food                             | Fashion                        |
| Digital financing   | • The majority of the F&B MSMEs are combining cash payment and banking services such as transfer, debit and credit payment  
                      • A few of them are using digital payment or financing  
                      • Some of the traditional micro-firms only uses cash payment | • The majority of the fashion MSMEs are combining cash payment and banking services such as transfer, debit and credit payment. Meanwhile,  
                      • A few of them are using digital payment or financing  
                      • Some traditional micro-firms only uses cash payment |
| Government role     | • The most frequent development programs received are training and exhibition  
                      • Some MSMEs have experienced other facilitation from the government, such as funding, production facilities, compliance assistance, competition, other promotion programs, and overseas benchmark and market search  
                      • Regulatory compliance is more complex  
                      • Protection of product copyright is needed | • The most frequent development programs received are training and exhibition. However, some MSMEs have experienced other facilitation from the government, such as funding and other promotion programs  
                      • No regulatory compliance issue arises  
                      • Protection of product copyright is needed |
is market sustainability. Some companies manage these issues by developing their value propositions, such as competence to provide healthy and environmentally friendly products to their customers; (ii) Human capital; most companies indicate a moderate level of digital proficiency in terms of the human capital aspect. Meanwhile, high-level proficiency is only possessed by a small number of MSMEs. Few MSMEs hold average-level digital competence, and some MSMEs still possess a below-average level of digital skill; (iii) Innovation; most companies are still using conventional tools to create their product variances for addressing the conventional market. The production capability development relies more on their own initiatives, such as by participating in training, mentoring, or self-exploration; (iv) Socio-technical adaptation; many actors provided various supports (finance, technical consultants, etc.) in assisting MSMEs adaptation for going digital, generally companies are more convenience to have face to face communication and transaction, which is culturally more accepted; (v) Digital financing; majority of MSMEs are still using a combination of cash and banking service payment. Several firms can utilize modern digital payments, and a few of them left behind are still using cash only; and (vi) Government role; training and exhibitions become the two most frequent government programs in the food sector. Most companies received various supports, such as funding, production facilities, compliance assistance, competition, other promotion programs, and overseas benchmark and market search.

**Fashion**

Despite the generic picture as shown in Table 2, there were two cases (SR and SH) performed well functioning of MSMEs ecosystem components. The first case is SR company: (i) Company’s digital markets were done by resellers to connect with e-commerce platform. The company collaborates with fellow companies to determine price and quality standards in mutually offering the excess orders, especially to meet export market demands; (ii) Company’s human capital worked in translating knitted designs from paper to computers, the company relies on programmers who are hired weekly and are paid for each designs that was entered into the computer; (iii) Company’s innovation has done to meet market demand, company continues to engage in capability upgrading by using computerized machines. The sources of idea on production innovation came from various interaction, from exhibition visits to the discussions with fellow knitting entrepreneurs who wanted to produce standardized products and better production quality by using automatic machines; (iv) Company’s socio-technical adaptation attempted to maintain the loyalty of resellers by fulfilling their order and accommodating orders spillover from other knitwear companies with excess orders as well; (v) Company’s digital financing entirely relied on its own capital, company owner along with several other knitting MSMEs form a business group called “interest-free,” which means a business group that refuses bank’s interest; (vi) Government role was minimum, because the digital MSMEs ecosystem is already functioning well, even though the government holds training, not all MSMEs are interested in training.

The second case is the SH company: (i) Company’s digital market generally sold in large volumes to retailers started exploring sales through an e-commerce platform.
(Shopee). The products sold online are different (in terms of models and lower prices) from those sold directly in large volumes in highly competitive wholesale markets; (ii) Company’s human capital operated embroidery machines by skill-full operators; the operators received direct training inside the company. The designers were chosen because of their creativity and experience; (iii) Company’s innovation done to meet market demand, company carried out capacity upgrading of its embroidery machines to produce more products in larger quantities. Designers were required every day to produce new designs which, if approved by the owner, it will be used in production; (iv) Company’s socio-technical adaptation shifted from manual to automation embroidery works, by quick adaptation to automation technology using computerized embroidery machines, the company can produce large quantities of any embroidery pattern quickly and directly; (v) Company’s digital financing relied on self-financing to pay for production costs; (vi) Government role was minimum, because the digital MSMEs ecosystem components are already functioning well, the city government support only needs to promote the image of the MSMEs to the visitors of embroidery center in the city.

Component of Digital MSMEs Ecosystem by Region

The component of digital MSMEs ecosystem by three regions: West Sumatra, West Java, and Yogyakarta are depicted in Table 3. The study highlights the important similarities and differences of ecosystem components in the three regions as follows: (i) Human capital; the majority of MSMEs in West Sumatra, already possess a moderate level of digital skill. Meanwhile, MSMEs digital skills range from average to moderate in West Java and Yogyakarta, and only a few highly skilled MSMEs of all three regions. In addition, below-average level digitalization skill MSMEs were identified in the Yogyakarta region; (ii) Digital financing; there are no substantial differences in the digital financing capabilities of MSMEs in the three regions. Furthermore, based on the case studies, some champions stand out among other MSMEs in every region; and (iii) Government role; training and exhibitions become the most frequent programs offered in all three regions in terms of government role. The important issue for MSMEs in West Sumatra is the continuity of government’s support to explore export market potential, due to difficulties in complying with buyers’ standards and requests, eventually, it did not continue. Meanwhile, government support programs in Yogyakarta tend to be more diverse, such as funding supports, procurement of production facilities, compliance assistance, competition, and overseas benchmarks.

Based on the regional characteristics, the digital MSMEs ecosystem component in three regions are (i) West Sumatra’s MSMEs demonstrate moderate level of socio technical adaptivity to digital application, they learn about digital technology from various sources including social media and digital platforms, business partners, local government, university staff, and partnerships with resellers. A few of them obtained digital assistance from the younger generation in their family by investing in digital websites. There was a platform of connecting disable producers with customers as a part of an inclusive digital economy; (ii) West Java’s MSMEs stand out
| Ecosystem component | West Sumatra | West Java | Yogyakarta |
|---------------------|--------------|-----------|------------|
| Digital MSMEs market | *The majority of MSMEs has capacity to serve national markets, and a few of them deliver to international market through informal channel, such as personal network and government promotion program.*<br>*To enter international market, MSMEs need to upgrade capability to meet international standard.* | *Most MSMEs has capacity to serve national market, whether they connected to digital or not.*<br>*This region gains competitive support from its location, where many distribution points and wholesale markets located in this region.* | *Majority of MSMEs has local markets in their business.*<br>*Digital application supports MSMEs to survive, stable or even increase their sales at local market.* |
| Human capital | *The majority of MSMEs possess moderate level of digitalization skill, some of them possess either high or average level of digital skill.*<br>Most MSMEs has digital skill ranging from average to moderate level<br>Some of them has high-level digital skill | *Most MSMEs has digital skill ranging from average to moderate level.*<br>*Some of them has high-level digital skill.* | *Most MSMEs has digital skill ranging from average to moderate level.*<br>*A few number of high digital skill.*<br>*MSMEs with below-average level of digital skill also exist.* |
| Innovation | *Most MSMEs has low level of innovativeness by creating simply product variances.*<br>*A few of them able to improve their product features and quality, also production processes.*<br>Majority of the MSMEs has moderate level of innovativeness by improving their product features and/or quality, also production processes | *Majority of the MSMEs has moderate level of innovativeness by improving their product features and/or quality, also production processes.*<br>Half of the MSMEs has a low level of innovativeness by creating simply product variances<br>*A few of them able to improve their product features and/or quality, and production processes.* | *Hyalf of the MSMEs has a low level of innovativeness by creating simply product variances.*<br>*A few of them able to improve their product features and/or quality, and production processes.*<br>*Some MSMEs are still reluctance to learn digital application.*<br>*Some of them already uses digital application for marketing and also production.* |
| Socio-technical adaptation | *Majority MSMEs uses digital application in supporting their connection to market.*<br>*A few MSMEs reluctance to learn digital.*<br>*A few MSMEs in digital services also develop local digital application to connect producers (disable people) with customers.* | *Majority of MSMEs uses digital application to support their link to market.*<br>*A few of them have utilize digital in production.* | *Some MSMEs are still reluctance to learn digital application.*<br>*Some of them already uses digital application for marketing and also production.* |
| Ecosystem component | State of digitalization by region |
|----------------------|----------------------------------|
|                      | West Sumatra                     | West Java                        | Yogyakarta                                      |
| Digital financing    | • Majority of MSMEs in West Sumatra are combining cash payment and banking services such as transfer, debit and credit payment  
• A few of them are using digital payment or financing. Some of the traditional micro-firms only use cash payment  
• Majority of MSMEs uses cash payment and banking services such as transfer, debit and credit payment  
• A few of them are using digital payment or financing  
• Some of the traditional micro-firms only use cash payment  
• Majority of the MSMEs uses combining cash payment and banking services such as transfer, debit and credit payment  
• A few of them are using digital payment or financing  
• Some of the traditional micro-firms only use cash payment |
| Government role      | • Most frequent development programs received are training and exhibition  
• Some MSMEs have experienced other facilitation from the government, such as funding, promotion, and export market search  
• Most frequent development programs received are training and exhibition  
• Some MSMEs have experienced another facilitation from the government, such as compliance assistance  
• Most frequent development programs received are training and exhibition  
• Some MSMEs have experienced other facilitation from the government, such as funding, production facilities, compliance assist, competition, and overseas benchmark |
for the relatively high level of innovativeness. They benefit from the existence and
density of industrial clusters and the availability of digitally literate human resources
in the region. West Java has a dynamic and advanced market (dynamic demand,
large scale market), and support (technical) from technology suppliers has driven
MSMEs to invest in the used digital machinery. It increases production and pro-
ductivity, but there are some challenges reducing labor absorption, creating unique
design products, exposing international competitors, and risky production due to
component shortages; and (iii) Yogyakarta’s MSMEs demonstrate low level of socio
technical adaptivity to digital application, they are generally thoughtful (the local
term is “slow but sure”) to digitalize their business process for two reasons: (i) cal-
culation of unsecured market demand after digitalization; (ii) social reluctance to
digitalization sometimes influenced by the social habits of “nrimo.”

Discussion

Constraints of Putting the Digital MSMEs Ecosystem to Work

Viewed from the model of digital MSMEs ecosystem (Fig. 1), all components of
MSMEs ecosystem have constraints to function to some degrees, in the following.

The component of digital MSMEs market has increased or at least make the mar-
ket stable, while some MSMEs have moved up from local to national market play-
ers. In terms of human capital, there are some constraints: (i) Top management or
MSMEs owner education and businesses core, higher education level which is in
line with their business core make them to easily understand the business core val-
ues and capable of producing innovative products; (ii) MSMEs owner age has a rela-
tionship with digital literacy. The younger generations with higher digital skill are
easier in adopting digital technology than the older one; (iii) The transfer of heredi-
tary knowledge from the owners to their family businesses’ young generations. The
successful MSMEs in digitalizing their business are usually handled by the second
or third generation and employ the dedicated employees; and (iv) Supports for self-
learning and exploration may also might bring unique skills, such as facilitating the
market for specific products produced by disable people.

In terms of innovation, the critical roles of MSMEs collaborative partners are
essential in the co-creation process, especially for product improvements that are
made by order. The collaborative partners are vital to develop their own capabili-
ties as well as support and mentor other smaller MSME capabilities. Collaboration
also educate their stakeholders, such as resellers, suppliers, and partners, especially
related to their product knowledge. Furthermore, viewed from socio-technical con-
straints, the social reluctances to use digital are related to the following: (i) social
habits are more convenient to have physical transactions, (ii) fewer customers have
access to digital, especially in the rural area, and (iii) the problems with digital lit-
eracy. Other constraints of embracing digital technology for MSMEs due to lack
of work divisions among workers. Most of the businesses are self-employed busi-
nesses or have limited workers. Therefore, the work is usually unspecialized as one
worker responsible for many job orders, therefore they do not have enough time to
learn and implement digital technology. Moreover, digital financing provided a variety of facilities for digital finance transactions along with several financial support schemes for MSMEs. Then, two important issues arise in terms of government role among MSMEs: (i) the information accessibility and facility to participate in every government program for MSMEs, (ii) the digital security related to the protection of copyrights for MSMEs products.

**Putting the Digital MSMEs Ecosystem to Work**

As previously discussed, each component of digital MSMEs ecosystem have its constraints to bring the system functioned well. Viewed from the system principles, driving the positive feedback loops (Fig. 1) by easing the main constraints are the leverage points to put the whole system to work (Meadows, 1999). Putting the digital MSMEs ecosystem to work needs to ease *three main* constraints on (i) human capital in digital talent, (ii) socio-technical adaptation, and (iii) government support.

**First, Building the MSMEs Human Capital in Digital Talent**

In the long run, it is part of preparing Indonesia’s digital talent, which related to (i) education sector especially vocational education, as the place of preparing the digital talent, (ii) government role to provide education, training, and programs of digital talent for all people by maintaining equality and equal rights to get opportunities, (iii) professional organizations as the place for talent professionals to carry out the duties of trust and responsibility in digital era, and (iv) business and industry sector, including MSMEs, where digital talent get remuneration and rewards for their competency (Wantiknas, 2020b).

In the short run, the increase of human resources capacity through training for MSMEs is acquired by sharing knowledge, skills, and experiences in digital talent. The success of the training for MSMEs in digital talent is determined by four factors: (i) Age, education, and former experience employees in digital become a good foundation for digital MSMEs; (ii) Owners good entrepreneurial skill is influential, especially in elevating MSMEs up to higher class in either national and global business; (iii) MSMEs that actively pursue attending the talent development programs tend to speed up capability acquisitions; and (iv) An effective and specialized work division on digital is essential to make employees more focused on managing and operating digital technology.

**Second, Accelerating Socio-Technical Adaptation to Digital Application**

Digital MSME activities in e-commerce and e-business are essentially sharing economy by collaborative partners through digital applications. The MSMEs acceptance of using the digital application is socially determined by people trusting digital applications to work collaboratively in the digital economy. Building mutual trust for collaboration at the organizational level is a long process, not to mention at the societal level is time-consuming (Ansell and Gash, 2007). Managing socio-technical *transition* from conventional to digital regimes is a long way process (Geels, 2004), the viable step is the acceleration of socio-technical *adaptation* to new business
There are three important factors affecting socio-technical adaptation to digital application: time, trust, and interdependence (Ansell & Gash, 2007). MSMEs need to apply two solutions: (i) Driving collaborative management and operation need to focus on the group of MSMEs at firms level, which the members of groups are ready to cooperate digitally in sharing economy. This solution is learning from the successful cases of adapting to digital application by companies SR and SH (findings by sectors). Intervention support for MSME firms who are not ready for collaborative operation is a time-consuming process for trust-building. The time necessary for trust building is likely to increase for the more the unreadiness MSMEs in the process, the solution is in the following step. (ii) Institutional nurturing on collaborative management and operation for the MSMEs center in the regions of low readiness for collaboration, for example, Batik MSMEs center in Yogyakarta region, textile and apparel MSMEs center in Bukittinggi, West Sumatra region.

The institutional nurturing by government support for the two aforementioned regions needs to consider the possible reluctance from social environment in the each regions. The government supports for the collaborative management and operation need to be implemented by two stages as follows: (i) The key of collaboration is trust-building to digital and the awareness of MSME owners on interdependence. We found in West Sumatra’s cases that individual competition among MSMEs related to still low trust for cooperation. However, they could work collaboratively if the MSMEs were interdependent by family and ethnic clan relationships. (ii) Interdependence fosters the willingness to participate in meaningful collaboration. We found in Yogyakarta’s case that it would be faster to build trust under the societal culture with strong in-group solidarity or interdependence. Both in West Sumatra and Yogyakarta, MSMEs’ actors who enter into a collaborative process at the beginning may not perceive themselves to be interdependent. However, through facilitating dialog and engagement by the government role, the intermediate outcome of MSMEs adaptation to the digital application could be achieved in stages.

Third, Sustainability of Existing Government Support for MSMEs Going Digital

The sustainability of the existing program needs to be continued to create an inclusive digital economy that includes urban and rural areas, all sectors, and all actors of MSMEs. The existing government programs for MSMEs going digital has been implemented by several related agencies, such as: (i) procurement expenditure platform for MSMEs initiated by the Ministry of SOEs (state-own enterprises), (ii) e-catalog portal (MSMEs page) to support MSMEs digital businesses operation provided by the ministry of cooperative and MSMEs, (iii) banking support for MSMEs going online through the marketplace (Indonesian Mall) and online market (Web market BRI) provided by BRI (Bank of Indonesian People) (Deloitte, 2021).

Viewed from a program provider, there are four types of programs provided by the government that should be maintained its continuity for the acceleration of SMEs digitalization: (i) the development of marketplace and application to support MSMEs market expansion as well as the data center to ensure that the customer is
the focus of digital market expansion; (ii) training and mentoring to increase the digital capacity of MSMEs, by which MSMEs’ digital capacity could offer coherence across online and offline channels; (iii) collaboration with other parties to provide easy access and services for MSMEs through leveraging big data to improve real-time decisions across MSMEs value chain; and (iv) improving digital infrastructure and facilities, especially on cybersecurity, to protect the information capital of MSMEs in a connected world (Das et al., 2016).

Conclusion

This study concludes that the interactive components of digital MSMES ecosystem for inclusive digital economy, more specifically the ways of putting the digital MSMEs ecosystem to work, are for accelerating the MSMEs digitalization in Indonesia. The multiple case studies’ findings and discussion supported the novelty of digital MSMEs ecosystem model. The novel model of the digital MSMEs ecosystem was formulated as the surrounding interactive components of ecosystem, enabling digital MSMEs to realize and accelerate toward the digital economy in Indonesia. Putting the model to work is creating a digital MSMEs market as the main objective, through continuously positive feedback interaction between six components, controlled by the regular government role.

The multiple case studies found that all components of MSMEs ecosystem have constraints to function to some degrees. There are three main constraints of digital MSMEs ecosystem to work: (i) human capital in digital talent, (ii) socio-technical adaptation, and (iii) government support. Putting the digital MSMEs ecosystem to work needs three ecosystem resolutions:

- First, building the MSMEs human capital in digital talent should strengthen (i) owner’s basic skill for digital MSMEs; (ii) owner’s entrepreneurial skill for managing digital MSMEs; (iii) MSMEs proactive attending the talent development programs; (iv) MSMEs labor’s work division on digital.
- Second, acceleration of socio-technical adaptation to the digital application by (i) driving collaborative management and operation should focus on the group of MSMEs at firms level, which the members of groups are ready to cooperate digitally in sharing economy; and (ii) institutional nurturing on collaborative management and operation for the MSMEs center in the regions of low readiness for collaboration.
- Third, the sustainability of existing government support for MSMEs going digital needs to be continued to create an inclusive digital economy that includes urban and rural areas, in all sectors, and for all actors of MSMEs. New programs on aforementioned human capital in digital talent and socio-technical adaptation should be implemented and maintained their continuity for the acceleration of SMEs digitalization.

Scientific and practical contributions of this study are the following: (i) The model of digital MSMEs ecosystem viewed from policy perspective enriched the existing ecosystem models in literature. (ii) In putting the model to work, this study
recommends the implementation of three digital MSMEs ecosystem resolutions by considering sectoral and regional characteristics in practices.

Appendix

Appendix Table 4 Profile of MSMEs digitalization in West Sumatra

| Firm | Commodity | Product | Worker | Market | State of digitalization |
|------|-----------|---------|--------|--------|-------------------------|
| ZS   | Fashion   | Handmade embroidery garment | 15 workers, subcontract (max 10 workers) | Local, Indonesia and International | Conventional (through exhibitions and workshop, using social media for communication only) |
| BM   | Food      | Food ingredients | 3 workers, temporary workers (max 6 persons), reseller | Local, Indonesia, International | E-commerce (communication through social media, and resellers) |
| TL   | Fashion   | Handmade batik clothes | 20 workers (now 3 workers at workshop, work from home), dedicated digital staff | Local, Indonesia (Jakarta) | E-commerce (through website), conventional (shop) |
| AF   | Furniture | Home and office furniture | 13 workers, digital staff (owner) | Local, neighborhood province | E-commerce (through social media and website), e-business (interior design software and administration software) |
| DC   | Food      | Culinary (daily bread and cakes) | 6 workers, dedicated digital staff | Local, Indonesia | E-commerce (through social media and website) |
| KM   | Fashion   | Handmade embroidery clothes | Around 10 workers, subcontract resellers | Local, Indonesia, international | Conventional (shop & exhibitions), e-commerce (through social media & resellers) |
| LE   | Food      | Culinary (daily bread and cake) | 3 workers (family) | Local | Conventional (shop & individual marketer) |
| CH   | Food      | Dried traditional food & food ingredients | 20 workers, more than 10 SMEs partners resellers | Local, Indonesia | E-commerce (social media, marketplace, resellers) and conventional (shops) |
| KE   | Food      | Organic fresh product, cookies and processed food | A group of disable workers | Local | E-commerce (website), marketplace |
## Appendix Table 5  Profile of MSMEs digitalization in West Java

| Firm | Commodity | Product                     | Worker | Market                          | State of digitalization                                                                 |
|------|------------|-----------------------------|--------|---------------------------------|----------------------------------------------------------------------------------------|
| SR   | Fashion    | Knitwear products           | 11 worker including 2 owners, 1 operator, 1 QC; and 1 programmer, 7 technicians | National (wholesale market and large shopping centers) in Java (mostly)                  | Early e-business (automation in production), e-commerce (mobile communication, online messenger, and on-line platform by reseller) |
| SO   | Fashion    | Men’s shoes, shoe repair service, customized shoe | 7 workers including 4 owners, 3 workers, and outsourcing craftsmen | National in West Java (mostly) and Sulawesi                                             | Manual production, conventional marketing (physical stores), e-commerce (on-line platforms since COVID-19) |
| KB   | Fashion & Craft | Wicker crafts, e.g. hats, bags, hamper | Self employee by owner outsourcing to craftsmen | National market (retail and wholesale)                                                   | Conventional marketing, (unfamiliar with social media, reluctance to learn) |
| RC   | Fashion    | Hijab products              | 43 people including 3 owners, 10 tailors, and 30 sequins tailors | National market (retail and wholesale)                                                   | Manual production (sewing process), e-commerce (social media and online platform since COVID-19) |
| SH   | Fashion    | Embroidery and non-embroidery garments, muslimwear | 220 workers, including 200 tailors, 16 operators, dan 2 designers, 2 IT staff | National (wholesale market), International market (Malaysia)                          | Manual production (non-embroidery), early digitalization/ automation (embroidery), e-commerce (online platform for non-embroidery) |
| OS   | Fashion    | Shoes, sandals              | Self employee by 2 owners and its family | National (wholesale and retail markets)                                                 | Conventional marketing (direct sales), e-commerce (social media and on-line platform since COVID-19) |
| MT   | Fashion    | Prayer robes                | Self employed collaborate with craftsmen | National (wholesale purchase only)                                                      | E-commerce (own website), e-business (data analytic for business analysis)               |
| WK   | Food       | Fresh and processed organic products | Self employed collaborate with organic farmers | Regional (fresh products), national (processed product)                                | E-commerce (social messaging platform, e-commerce platforms)                              |
Appendix Table 6  Profile of MSMEs digitalization in Yogyakarta

| Firm | Commodity | Product | Worker | Market | State of digitalization |
|------|-----------|---------|--------|--------|-------------------------|
| GJ   | Food      | Functional food (edible and medicinal mushrooms) | 31 workers including 1 owner | National (mostly Java as the largest chunk) | E-commerce, digital marketing through B-to-B channels (restaurant, catering, hotel, and retailer) |
| BS   | Food      | Traditional snack (Bakpia) | 15 workers including 2 owners | Regional (Yogyakarta province) | E-commerce, mix off line with on-line marketing (social media and e-online platforms, e.g., Sibakul) |
| LH   | Craft     | Leather wallet, leather key chain, and accessories | 3 workers including 1 owner and 2 worker | Local (Yogyakarta city) | Conventional marketing (disability community networks and local retailers) |
| SK   | Craft     | Tailor-made wooden craft | 8 workers including 1 owner | Local Yogyakarta city | Conventional marketing (B-to-B through cooperative and association), use Whatsapp for communicating with clients |
| IP   | Food      | Traditional fish dishes (dine-in and canned) | Self employee by the 1 owner | Local Yogyakarta city | Conventional marketing (B-to-B through consignment with restaurant) |
| KS   | Food      | Traditional cassava cracker | Self employee by owners with heredity | Local Yogyakarta city | Conventional marketing (B-to-B with traditional retailers) |
| SP   | Food      | Instant cereal | Worker 82 including 1 owner | National (meet demand up to 1 million packs per annum) | E-commerce (digital marketing in distributors and resellers), mix online-offline in B-to-B channels to meet variety of customers |
| BL   | Food      | Traditional jack fruit dish | 16 workers including owners with heredity | National (mostly Java) | E-commerce (digital marketing handled by distributors and resellers), the company focus on production, offline sales |
| BB   | Fashion   | Batik garment and textile cloth | 18 workers including 1 owner | International (Japan and UAE), national market | E-commerce (digital marketing mostly social media and online platform such as Sibakul) |
**Author Contribution** Erman Aminullah is a Research Professor at the Economic Research Center (P2E), the Indonesian Institute of Sciences (LIPI), Jakarta. He is an Associate Editor in Chief (for Southeast Asia) of Asian Journal of Technology Innovation. Trina Fizzanty is a Senior Researcher at the Economic Research Center (P2E), the Indonesian Institute of Sciences (LIPI), Jakarta. Nawawi Nawawi is a

---

**Appendix Fig. 2** Iteration process of model construction
Senior Researcher at the Research Center for Population Studies (P2K), the Indonesian Institute of Sciences (LIPI), Jakarta. Joko Suryanto is a Senior Researcher at the Economic Research Center (P2E), the Indonesian Institute of Sciences (LIPI), Jakarta. Nika Pranata is a Researcher at the Economic Research Center (P2E), the Indonesian Institute of Sciences (LIPI), Jakarta. Ikbal Maulana is a Senior Researcher at the Research Center for Culture and Society, the Indonesian Institute of Sciences (LIPI), Jakarta. Lutfina Ariyani is a Researcher at Center for STI policy and management (RC-STIPM), the Indonesian Institute of Sciences (LIPI), Jakarta. Adityo Wicaksono is a Researcher at Center for STI policy and management (RC-STIPM), the Indonesian Institute of Sciences (LIPI), Jakarta. Ikval Suardi is a Researcher at the Economic Research Center (P2E), the Indonesian Institute of Sciences (LIPI), Jakarta. Nyimas Latifah Letti Azis is a Senior Researcher at the Research Center for Political Studies (P2P), the Indonesian Institute of Sciences (LIPI), Jakarta. Aisah Putri Budiatri is a Researcher at the Research Center for Political Studies (P2P), the Indonesian Institute of Sciences (LIPI), Jakarta. All authors had equal contribution and had final responsibility for the publication.

**Funding** The study was financed by the research grant of Fund Management Institute for Education (LPDP) as stipulated by the LPDP director decree No. 32/KEP/2020 for the research project on Developing the model of digital economy ecosystem for SMEs in Indonesia and for this supports, authors express gratitude.

**Declarations**

**Conflict of Interest** The authors declare no competing interests.

**References**

Ansell, C., & Gash, A. (2007). Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory, 18*, 543–571.

Bachtiar, P. P., Diningrat, R. A., Kusuma, A. Z. D., Izzati, R. A., & Diandra, S. (2020). *Who is digital economy for? Toward an inclusive digital economy in Indonesia*. Smeru Research Institute. (in Indonesian).

Capri, A. (2019). *Micro and small businesses in Indonesia’s digital economy*. Asia Pacific Foundation of Canada.

Crupi, A., Del Sarto, N., De Minin, A., Gregori, G. L., Lepore, D., Marinelli, L., & Spigarelli, F. (2020). The digital transformation of SMEs – a new knowledge broker called the digital innovation hub. *Journal of Knowledge Management, 24*(6), 1263–1288.

Dahbi, S., & Bennoussa, C. (2019). What hinder SMEs from adopting e-commerce? A multiple case analysis. *Procedia Computer Science, 158*, 811–818.

Dannenberg, P., Martina, F., Tim, R., & Cathrin, W. (2020). Digital transition by COVID-19 pandemic? The German food online retail. *Tijdschrift Voor Economische En Sociale Geografie, 3*(3), 543–560.

Das, K., Gryseels, M., Sudhir, P., & Tan, K. T. (2016). Unlocking Indonesia’s digital opportunity. McKinsey Indonesia Office.

Deloitte. (2021). *Realizing the potential of Indonesia’s digital economy*. Deloitte Touche Solutions.

Eisenhardt, K. M. (1989). Building theories from case study research. *The Academy of Management Review, 14*(4), 532–550.

Ganne, E., & Lundquist, K. (2019) The digital economy, GVCs and SMEs. In WTO, *Technological innovation, supply chain trade, and workers in a globalized world* (pp. 121–139). WTO.

Garzoni, A., De Turi, I., Secundo, G., & Del Vecchio, P. (2020). Fostering digital transformation of SMEs: a four levels approach. *Management Decision., 58*(8), 1543–1562.

Gay, C., & Szostak, B. L. (2019). *Innovation and creativity in SMEs: Challenges, evolutions and prospects*. John Wiley & Sons.

Geels, F. W. (2004). Understanding system innovations: a critical literature review and a conceptual synthesis. In B. Elzen, F. W. Geels, & K. Green (Eds.), *System innovation and the transition to sustainability, theory, evidence, and policy* (pp. 19–47). Edward Elgar Publishing.

Golley, F. B. (1993). *A history of ecosystem concept in ecology: More than the sum of the parts*. Yale University Press.
Hanna, N. (2018). A role for the state in the digital age. *Journal of Innovation and Entrepreneurship*, 7(5), 1–16.
Harland, W., & Whitmore, J. (2007). The world economy, population growth, and the global ecosystem. Palgrave Macmillan.
Hasna, A. M. (2009). Contemporary society, technology and sustainability. *International Journal of Technology, Knowledge and Society*, 55(1), 13–20.
Huang, B. (2019). A Research on the influence of digital inclusive finance on financing constraints of SMEs. *Advances in Economics, Business and Management Research*, 109, 545–550.
IBRD/World Bank. (2020). Promoting digital and innovative SME financing. IBRD/World Bank.
Joo, J., & Shin, M. (2018). Building sustainable business ecosystems through customer participation: A lesson from South Korean cases. *Asia Pacific Management Review*, 23, 1–11.
Kaarainen, J., Pussinen, P., Saari, L., Kuusisto, O., Saarela, M., & Hanninen, K. (2020). Applying the positioning phase of the digital transformation model in practice for SMEs: Toward systematic development of organization. *International Journal of Information Systems and Project Management*, 8(4), 24–43.
Kabanda, S., & Brown, I. (2017). A structuration analysis of small and medium enterprise (SMEs) adoption of e-commerce: The case of Tanzania. *Telematics and Informatics*, 34(4), 118–132.
Karpunina, E. K., Okunkova, E. A., Sazanova, E. V., Gubernatorova, N. N., & Tishchenko, E. S. (2020). The ecosystem of the digital economy: a new approach to the study of structural features and content. In Popkova E., Sergi B. (Eds.) *Scientific and Technical Revolution: Yesterday, Today and Tomorrow* (pp. 497–508). Springer, https://doi.org/10.1007/978-3-030-47945-9_55
Klein, V. B., & Todesco, J. L. (2021). COVID-19 crisis and SMEs responses: The role of digital transformation. *Knowledge and Process Management*, 28(2), 117–133.
Kusumaningtyas, N., & Suwarto, D. H. (2015). ICT adoption, skill and use differences among small and medium enterprises managers based on demographic factors. *Procedia - Social and Behavioral Sciences*, 169, 296–302.
Leviakangas, P., & Oorni, R. (2020). From business models to value networks and business ecosystems – What does it mean for the economics and governance of the transport system? *Utilities Policy*, 64, 101046. https://doi.org/10.1016/j.jup.2020.101046
Li, L., Su, F., Zhang, W., & Mao, J. Y. (2018). Digital transformation by SME entrepreneurs: a capability perspective. *Information Systems Journal*, 28(6), 1129–1157.
Li, W., Liu, K., Belitski, M., Ghabadian, A., & O’Regan, N. (2016). E-leadership through strategic alignment: An empirical study of small- and medium sized enterprises in the digital age. *Journal of Information Technology*, 31, 185–206.
Major, J. (1969). Historical development of the ecosystem concept. In G. M. van Dyne, (Ed.), *The ecosystem concept in natural resource management* (pp. 9–20). Academic press.
Martin, F. M., Ciovica, L., & Cristescu, M. P. (2013). Implication of human capital in the development of SMEs through the ICT adoption. *Procedia Economics and Finance*, 6, 748–753.
Meadows, D. (1999). *Leverages points: Place to intervene in a system*. The Sustainability Institute.
Ministry of Cooperation and SMEs. (2020). *Data progression on MSME and large business 2018–2019*. Ministry of Cooperation and SMEs. (In Indonesian).
Moertini, V. S. (2012). Small medium enterprises: On utilizing business-to-business ecommerce to go global. *Procedia Economics and Finance*, 4, 13–22.
Moller, K., Nenonen, S., & Storbacka, K. (2020). Networks, ecosystems, fields, market systems? Making sense of the business environment. *Industrial Marketing Management*, 90, 380–399.
Ningsih, R., Sahara, S., Febrinda, R. R., Menanti, S., & Andhi, A. (2019). Determinant factors of SMEs in adopting e-commerce in Indonesia. *Advances in Economics, Business and Management Research*, 98, 29–33.
Norqvist, L. (2018). *Analysis of the digital transformation of society and its impact on young people’s lives*. The European Union-Council of Europe Youth Partnership.
Pilinkiene, V., & Maciulys, P. (2014). Comparison of different ecosystem analogies: The main economic determinants and levels of impact. *Procedia - Social and Behavioral Sciences*, 156, 365–370.
Sarosa, S. (2012). Adoption of social media networks by Indonesian SMEs: A case study. *Procedia Economics and Finance*, 4, 244–254.
Saunila, M., Ukko, J., & Rantala, T. (2019). Value co-creation through digital service capabilities: The role of human factors. *Information Technology & People*, 32(3), 627–645.
Savrula, M., Incekarab, A., & Sener, S. (2014). The potential of e-commerce for SMEs in a globalizing business environment. *Procedia - Social and Behavioral Sciences*, 150, 35–45.
Sen, D., Ozturk, M., & Vayvay, O. (2016). An overview of big data for growth in SMEs. *Procedia - Social and Behavioural Sciences, 235*, 159–167.

Sin, K. Y., Osman, A., Salahuddin, S. N., Abdullah, S., Lim, Y. J., & Sim, C. L. (2016). Relative advantage and competitive pressure towards implementation of e-commerce: Overview of small and medium enterprises (SMEs). *Procedia Economics and Finance, 35*, 434–443.

Strohmaier, R., Schuetz, M., & Vannuccini, S. (2019). A systemic perspective on socio-economic transformation in the digital age. *Journal of Industrial and Business Economics, 46*, 361–378.

Szopa, L., & Cyplik, P. (2020). The concept of building digital transformation model for enterprises from the SME sector. *Logforum, 16*(4), 593–660.

Tolstoy, D., Nordman, E. R., Hanell, S. M., & Ozbek, N. (2020). The development of international e-commerce in retail SMEs: an effectuation perspective. *Journal of World Business, 56*(3), 101165.

Tsujimoto, M., Kajikawa, Y., Tomita, J., & Matsumoto, Y. (2018). A review of the ecosystem concept — Towards coherent ecosystem design. *Technological Forecasting & Social Change, 136*, 49–58.

Ueasangkomsate, P. (2015). Adoption e-commerce for export market of small and medium enterprises in Thailand. *Procedia - Social and Behavioural Sciences, 207*, 111–120.

Ulas, D. (2019). Digital transformation process and SMEs. *Procedia Computer Science, 158*, 662–671.

Wantiknas. (2020a). *Digital transformation for MSME*. Retrieved July 4, 2021, from https://www.wantiknas.go.id/wantiknas-storage/file/ebuletin/2020a1119_e-Buletin%20Wantiknas_Transformasi%20Digital%20Untuk%20UMKM_Edisi%202010.pdf

Wantiknas. (2020b). *Preparing Indonesia’s digital talents*. Retrieved July 4, 2021, from https://www.wantiknas.go.id/wantiknas-storage/file/ebuletin/2020b0813_e-Buletin%20Wantiknas_Mempersiapkan%20Talenta%20Digital%20Indonesia_Edisi%202007.pdf

Yanuardani, M. (2018). Exploring talent management potential in digital-savvy SMEs: a case study from Yogyakarta, Jakarta, and Bandung. *Jurnal Perencanaan Pembangunan: The Indonesian Journal of Development Planning, 2*(2), 138–151.

Yin, R. K. (2014). *Case Study Research Design and Methods* (5th ed.). Sage.

**Publisher’s Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

**Authors and Affiliations**

**Erman Aminullah**¹ · **Trina Fizzanty**¹ · **Nawawi Nawawi**² · **Joko Suryanto**¹ · **Nika Pranata**¹ · **Ikbai Maulana**³ · **Luthfina Ariyani**⁴ · **Adityo Wicakseno**⁴ · **Ikval Suardi**¹ · **Nyimas Latifah Letty Azis**⁵ · **Aisah Putri Budiatri**⁵

Trina Fizzanty
trin002@lipi.go.id

Nawawi Nawawi
nawa001@lipi.go.id

Joko Suryanto
joko010@lipi.go.id

Nika Pranata
nika001@lipi.go.id

Ikbai Maulana
ikba002@lipi.go.id

Luthfina Ariyani
luth004@lipi.go.id
Adityo Wicaksono
adit006@lipi.go.id
Ikval Suardi
ikval001@lipi.go.id
Nyimas Latifah Letty Azis
nyim001@lipi.go.id
Aisah Putri Budiatri
aisa001@lipi.go.id

1 Economic Research Center (P2E), the Indonesian Institute of Sciences (LIPI), Jakarta, Indonesia
2 Research Center for Population Studies (P2K), the Indonesian Institute of Sciences (LIPI), Jakarta, Indonesia
3 Research Center for Culture and Society, the Indonesian Institute of Sciences (LIPI), Jakarta, Indonesia
4 Research Center for STI Policy and Management (RC-STIPM), the Indonesian Institute of Sciences (LIPI), Jakarta, Indonesia
5 Research Center for Political Studies (P2P), the Indonesian Institute of Sciences (LIPI), Jakarta, Indonesia