



Creating a digital ecosystem for sustainable development: Insights from Indonesian micro, small and medium enterprises

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Abstract

Indonesia's micro, small, and medium enterprises (MSMEs) are experiencing competitive contention with the development of information and communication technology-based businesses. However, MSMEs play a significant role in most developing countries due to their contributions to economic growth. The COVID-19 lockdown brought the economic constraints, yet it also has had a positive impact, the pandemic has become a catalyst to accelerate digital-based development. The novelty of this study lies in two aspects. First, substantively, is the use of a systems approach, especially the autopoietic concept in reading the development of a digital-based MSME system. Second, in terms of the object of study, the MSME system in the Special Region of Yogyakarta (DIY), Indonesia, and the development of digitalization are of course the strengths of this work. In this study, the researchers describe how the MSME system responds to environmental changes. Likewise, the autopoietic concept puts emphasis on self-referential, namely, the development of a system based on his own needs through communication, which will be closely related to the sustainability of the digital-based MSME system. From a systems perspective, the resonance capability of the system in the digital ecosystem will also be detected. The study employed a qualitative approach. Using MSMEs in the DIY as a case study, this article aims to describe these enterprises' dynamic responses to the growth of digital technology as well as their role in forming a digital ecosystem. An in depth-interview was used to collect data from selected participants from both MSME and government actors. The findings reveal that the sustainability of the MSME system in DIY is determined by the internal systems' responses to the latest advances in digital technology as well as the ecological quality of the system, especially as related to the resonance of MSMEs' subsystem. Autopoietic mechanisms are represented through the communication discourses of system-forming elements covered by support from the government, business, and higher education sectors as well as the local community. However, problems are still evident, so the integration and synergy of the digital MSME ecosystem diverse elements are necessary to ensure sustainable development in the future.

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Introduction

Currently, MSMEs are encouraged to take advantage of the digital media and continuously strive to be able to go online in order to face the competition that is present at both national and global levels. Efforts to encourage the digitalisation of MSMEs have gotten stronger during the COVID-19 outbreak. The pandemic has brought various challenges and created uncertainty in maintaining business continuity for MSMEs (Zutshi et al., 2021). Digital tools are adopted and mastery of new skills is improved for MSME business resilience (Fitriasari, 2020). The digital transformation of MSMEs continues to be campaigned so that it can become a solution for MSMEs to enter the world 4.0.

Recent data indicate that, by the second quarter of 2020, 73.7 percent of Indonesia's 266.91 million people had access to the internet. With the rise in internet usage, network action has increased. The digital environment, in other words, has allowed the formation of an increasingly broad communication network.

In this context, MSMEs have experienced the most significant development. The migration from analog to digital technology has been marked by the rise of several platforms that have provided businesses with the ability to grow while streamlining their processes, increasing market reach, and innovatively accessing customers (Ahmad et al., 2015). Communication technology has been used widely to make communication more efficient.

At the same time, business is always characterized by healthy competition, and this means that business owners must pay attention to the impending digital technology revolution. Businesses must increase productivity and work without paper, using digital data collection to improve efficiency and reduce costs (Bogavac et al., 2020). Such a digital ecosystem would allow MSMEs to penetrate the global market, ensure product innovation, improve competitiveness, and gain complete access to knowledge networks.

In addition, technological advances and globalization need to be taken into account in the process of sustainable development (Servaes, 2016; Servaes et al., 2012). However, the reality is that inequality still occurs, some MSMEs are still experiencing setbacks. Several problems arise such as poor internet access in some areas, limited infrastructure coverage, low digital talent capabilities (National Information and Communication Technology Council, 2020). Based on the national data, according to the Indonesian E-commerce Association (iDEA),

in 2021, the MSME digital ecosystem reached only 21 percent of the total number of MSMEs (Lumanauw, 2021).

For MSMEs, the adoption of communication technology is not easy, especially with the rapid advancements in digital technology. There thus exists a wide gap between these enterprises and large companies (Bogavac et al., 2020). At almost all levels, businesses have experienced complexity due to environmental changes (Koskinen, 2013), needing to address issues of management, project objectives, planning, and technology.

Previously, De Berranger and Meldrum (2000) discussed MSMEs' usage of information and communication technology. MSMEs have also been at the center of efforts to understand the impact of using ICT on development (Qureshi, 2015). Studies of MSMEs have shown that macro-environmental factors and internal environments contribute to companies' performance as well as the performance of market economic aspects (Wu & Parkvithee, 2017). Furthermore, MSMEs need internal and external environmental support in developing their business strategies and carrying out digital transformation (Nambisan et al., 2019).

However, there has been limited discussion of MSMEs in the digital ecosystem. This study thus investigated the MSMEs located in DIY. After a literature review to explore relevant phenomena and concepts, this article provides an overview of MSMEs' dynamics within the digital ecosystem as well as the parties involved in the processes of autopoietic, digitalization, and sustainable development.

This study aimed to fill the gap in the MSMEs' dynamic to respond to the environmental changes. Specifically, this study covers a fundamental understanding of the autopoietic system and has focused on self-referential to reduce the complexity through communication. By using autopoietic as its framework, this article is expected to provide a new perspective for analyzing the social complexity of society, especially MSMEs. Initial analysis has shown the problems of MSMEs to be part of a system; as such, they require a systematic solution. One of the theories relevant to understanding the social system is Niklas Luhmann's notion of autopoietic, which is used here as a foundation for breaking down the problems and dynamics in MSMEs. Communication is an essential point in this research, which will contribute to sustainable development in a digital-based environment.

This current study identifies elements of the MSMEs' digital ecosystem in DIY. Each element is a subsystem involved in the growth of MSMEs, and all elements resonate with one another. Moreover, it also describes the role of communication technology as a part of the autopoietic system to establish a better digital ecosystem of MSMEs in the future. It may prove the power of the digital ecosystem toward sustainable development in the MSMEs context.

Literature Review

MSMEs Go Digital

Digital ecosystems are emerging as a new approach to catalyse sustainable regional development driven by MSMEs. Digital technology allows the distribution of information and networks in global public environment (Li et al., 2012). The digital ecosystem has the greatest potential that enables SMEs to compete on the global areas (Dini et al., 2011). The offered easy access to various digital platforms can be used as a virtual environment for the community to communicate with others regarding the experience of giving certain services or selling products (Hajli, 2014). Moreover, social networking sites specifically bridge an easy and inexpensive interactions between product providers and customers (Braojos et al., 2019). This change marks society in the era of information flow 4.0, where digital media has become a part of their daily life.

The internet provides part of the digital environment for MSME actors. It is important to note that the concept of digitalization is used to refer to a technological trend that has significantly changed society and the business environment (Reis et al., 2020), one wherein several dynamics have emerged. Undeniably, digitalization transforms business elements from analog to digital platforms (Hagberg et al., 2016). At the same time, it involves other processes, as well as new values (such as accessibility, availability, and transparency), and the phenomenon of intelligent machines connected to the power of information and digital technology (Reis et al., 2020).

Digitalization gained steam at the end of the second decade of the twenty-first century and wrought significant economic, social, and technological changes (Valenduc & Vendramin, 2017). At the same time, this digital ecosystem presented new challenges, such as the digital divide between MSMEs and other business actors. According to Hynes (2016), it is necessary to identify the challenges associated with MSMEs' adoption of digital

technology to select the best path, with potential factors including the interests, understandings, and digital skills of actors and business owners.

Digital technology allows MSMEs to coordinate their operations globally and locally in real-time, and the realization of its full potential (such as digital cooperation and interaction) is expected to help businesses navigate the continuous evolution of the global economy (Shivam, 2019). This is essential, as information processing has become the organizing principle of society and the basis for social action, which affects every sphere of human activity.

The digitalization of several socio-economic factors is a critical task for ensuring sustainable development around the world (Bobylev et al., 2018). It is also an important theme in the dynamic environment and constant changes that have marked productivity and the optimization of knowledge in the Industry 4.0 era. Sustainability has been a trending topic of research since the 1980s (Ordieres-Meré & Remón, 2020).

Sustainable development means meeting current needs without compromising the ability of future generations to meet their needs. Its overall goal is to determine the optimal economic, human, environmental, and technological systems (Kardos, 2012). This concept has also been discovered to require understanding the complex relationships between environmental, economic, and social processes at different scales, from local to global. It means seeking a solution that ensures society's future development by achieving specific strategic goals.

The Autopoietic System of Modern Society

The autopoietic system is a system that becomes the basic foundation for the MSME system to adapt and respond to its problems by being oriented to its own capacity. Niklas Luhmann, the most influential modern sociologist, offers the autopoietic system, defined as a self-referential system, as a means of describing the social system of modern society. Originally advanced by two Chilean biologists, Humberto Maturana and Francisco Varela (Vanderstraeten, 2012), the term autopoietic is derived from the Greek *autos*, meaning 'self', and *poiein*, meaning 'to produce' (Wahyuni, 2019). Autopoietic systems, thus, are systems that reproduce themselves from within themselves, just as a plant reproduces its cells with its cells (Lee, 2000; Luhmann, 2013). The main argument of Luhmann's work is the reduction of complexity. Social systems reduce complexity by retaining the ability to adapt in highly complex environments (Valentinov et al., 2018).

Luhmann argued that the basic idea of autopoietic applied to biological and many non-biological systems, and thus conceptualized social systems as akin to biological systems, reproducing their elements based on their elements (Ritzer, 2011). Autopoietic forms the background of Luhmann's theory (Bausch, 2015). Autopoietic systems work not only to produce and replace their own structures, but also everything that is used as a unit within the system itself (Durand, 2017). The components of the social system are the communicative events produced and reproduced by the communication network (Herrera-Vega, 2015; Riviera, 2013).

Autopoietic systems are operationally closed and have clear boundaries separating them from other social systems (Rodger, 2021). The boundary between the internal system and the external system is arbitrary, depending significantly on the ongoing autopoietic process whereby the system determines its boundaries with external systems outside itself by being oriented to its specific code. According to Luhmann, the self-referential system consists of three different dimensions: communication, evolution, and differentiation (Lee, 2000).

1. Social dimensions/Communication: The autopoietic process starts through the communication process that occurs between the internal system and the external system (i.e. the system outside itself). As a system, communication consists of a process of information selection, utterance, and understanding (Luhmann, 1992; Paetau, 2013; Vanderstraeten, 2012).

2. Temporal dimension/evolution: Evolution emerges as a dual structure that bridges the differences between the system and its environment. A central element of the theory of autopoietic is the concept of structural coupling, which refers to the relationship between systems and their environments.

3. Functional dimensions/differentiation: As the system shapes its operations, the categories of structures become increasingly complex and differentiated, thereby shaping the dynamics of the system in response to its environment.

Luhmann (1989; 2004) defines autopoietic signifies the closure of a system's organization. The self-reference of the complex of components and component-producing processes mutually reproduce themselves, and thereby integrate and unify the system. Organizational closure does not mean that the system cannot be affected at all by its environment, but it can react to its environment only in accordance with its own mode of operation, the mode of operation peculiar to it" (p xii-xiii). Since every operation is just one operation among many others, every operation in the system can be observed by other operations.

Observation is, more formally, to be understood as treatment as information based on a difference scheme, usually based on expectations that are met or not met. In this sense, there is a constant self-observation accompanying the operations in society, and this observation produces its effects alongside and often contrary to those intended by the operations (Luhmann, 1989; 2004).

In this research, the autopoietic perspective is applied to understand the communication processes involved in the growth of a digital-based MSME system in DIY. The dimensions involved in the system's growth, as well as the discourses involved in giving meaning to the digitalization process, are the focus of the study and its exploration of the autopoietic system. More profoundly, this study focuses on the issues raised as essential discourses in the growth of digitalized MSMEs and the differentiation—an expression of the formation of multiple structures—of the MSME system in the Special Region of Yogyakarta.

Because the digitalization of the MSME system in DIY is still ongoing, this article focuses on providing an overview of how its autopoietic system was formed and the resonance between the systems that shape it. The concept of resonance is associated with the relationship between the system and its environment, being used to describe how the system engages with other codes that are strongly relevant to the core system being formed. The resonance of other systems will evolutionarily become part of the core system if it continues to influence the growth of a system significantly. Furthermore, it will also be able to reflect ideas on how the digital ecosystem will appear at MSMEs in the future.

Methodology

The qualitative approach was adopted to explore the research topic, which involves social problems originating from individuals or groups. This approach is inductive and focuses on the characteristics of individuals and the importance of reporting a particular situation's complexity to interpret the data from the field (Creswell & Cheryl, 2018).

The research method was conducted using a case study to explore contemporary phenomena in actual reality (Yin, 2018). The specified type of case study is multiple case studies. The multiple case study method was chosen as it allows the researcher to explore the phenomenon using replication strategy. In the context of this research, the researcher intended to have in-depth

investigation on the phenomenon of digital ecosystem development in the context of communication for the development of MSMEs in DIY. The researcher carefully selected several units of relevant case analysis, so that it would be possible to explore differences between cases by replicating the findings across cases.

The problem with digital-based MSMEs is very complex, and this study analyses some categories as follows:

1. The digital-based MSME system in DIY, including an overview of MSMEs and their reasons for digitalization.
2. The subsystems involved in the growth of digital-based MSMEs and their resonance.
3. The future of the digital-based MSME ecosystem.

The research objects were parties that have responded to the digitalization of MSMEs, including the government, business actors, institutions of higher education, and the community. MSMEs in several locations (Bantul Regency, Kota Yogyakarta, and Sleman Regency) were selected including Wukirsari & Krobot craft centers, MSMEs communities in Mlati & Ngaglik districts. Each area is important in the creative economy and houses MSMEs that produce unique products. It is important to note that many MSMEs exist as a part of broader efforts to alleviate the high levels of poverty in DIY (Regional Development Planning Agency, 2020).

To answer the research questions, data were collected using semi-structured interviews between October 2020 and November 2021. Purposive sampling was used to identify potential participants. Of the interview participants selected, three were with leading MSME actors with significant decision-making power in MSME groups and three were MSME actors in each regency. At this stage, the researchers explored information about the dynamics of MSMEs in a digital-based ecosystem.

Further interviews were conducted with five government actors familiar with MSME issues in DIY. The researchers dug for information related to the response in building digital-based SMEs in DIY and its sustainability in the future. To collect supplemental data, the researchers conducted observations in each regency and collected relevant documents. Observation was used to analyze MSMEs' social problems and dynamic responses to environmental changes.

For data analysis, a multi-stage process that involved collecting data was used, identifying the case studies, developing case descriptions based on contextual information, and interpreting the data using case assertion. The researchers identified the data relevant to the research topic based on an exploration of the literature, which enabled them to produce knowledge and interpretive

meaning. The integrated knowledge was then evaluated and elaborated to ascertain how the findings answered the research questions. For verification, data triangulation was used. Aside from transcripts obtained from the interviews, the rich data collected through observation and documentation reviewed provided crucial insight.

Results

The research was conducted in DIY, a province-level autonomous region in Indonesia. Potential resources in the area include seasonal agriculture, marine resources, and tourism (both natural and cultural). Several areas have also been developed as industrial locations. DIY has strategically sought to increase its economic and cultural potentials, both of which are required to improve general welfare in the community. One major source of income is the MSME sector, which is perceived as an economic driver that can stimulate the revitalization of local businesses.

Digital-Based MSMEs in the Special Region of Yogyakarta

MSMEs have a significant role in the DIY economy, generating 79.6 percent of the region's Gross Regional Domestic Product. In addition, in August 2021 MSMEs employed 566,299 workers, 24.2 percent of the province's workforce of 2.34 million people (Statistics Indonesia, 2021). Data from the Department of Cooperatives and MSMEs, DIY, show that the number of MSMEs has increased. In 2020, DIY was home to 262,130 MSMEs. In terms of total enterprises, micro-scale enterprises are the most common, followed by small, medium, and large-scale ones. MSMEs operate in many sectors, including trade, agriculture, forestry, fisheries, transportation, communication, education, health, and non-agricultural industry.

Due to advances in information and communication technology, MSMEs in DIY have become increasingly dynamic. This has been necessary to respond to their changing environment, including the fact that: (1) consumers are increasingly relying on digital transactions, with 53 percent of consumers having shopped online previously; (2) internet penetration is increasing every quarter, with a record 196.7 million Indonesians having internet access in 2020; (3) digital campaigns have proven effective in developing consumer engagement, thereby enabling MSMEs to compete better; and (4) digital literacy levels remain low amongst MSME actors.

Given these conditions, many MSMEs have chosen to adopt digital technology. It is hoped that, through the usage of information and communication technology, MSMEs will be driven to access and compete in local, regional, national, and even global markets. Through the lens of autopoietic, MSMEs struggle to respond to their increasingly complex environment provides an internal system. This system's environment, including the government, corporations, universities, and the community, has provided proactive support for the development of digital-based MSMEs in DIY.

Resonance of Ecosystem Elements in the Development of a Digital-Based MSME System in DIY

The digitalization of DIY's MSMEs has been supported by various elements, including government agencies, corporations, higher education institutions, and the local community. From a systems perspective, all elements resonate in response to the digitalization process in the MSME system. All are committed to realizing a digital-based MSME ecosystem in DIY and have facilitated the adoption of relevant technologies. It will be explained in more detail as follows:

Government

DIY government believes that MSMEs have high levels of economic resilience and can thus provide a foundation for financial and economic stability. The DIY government has been committed to educating MSME actors, advancing their abilities, and supporting sustainable economic growth. This support has been manifested through several government programs, including the Desa Preuner and SiBakul programs.

1. The Desa Preuner program, which seeks to empower the rural economy through the spirit of entrepreneurship. The Desa Preuner program relies on two models: the G2R Tetrapreneur model, which follows the tenet of "one village, one product", and the K45PAK model, which is oriented more towards developing a digital environment for MSMEs.

2. The SiBakul program was developed to motivate MSMEs to use digital-based facilities to market their products. This program is oriented toward facilitating the digitalization of MSMEs by providing convenience in planning, implementation, and evaluation.

Government support for MSMEs is also evident through the central government's attention to the sector in recent years. For instance, in 2020 the Indonesian government campaigned extensively to realize the "Digital Energy of Asia", thereby facilitating MSMEs

and providing them with opportunities to compete in the broader market.

Corporations

As the issue of digitalization is a multifaceted one, it has attracted the response of diverse external stakeholders. These have several corporations and agencies, including:

1. PT Telkom Indonesia is a business entity that provides information and communication technology services. It has supported MSMEs by installing internet networks in several locations, often in partnership with the local government.

2. Financial support has been provided by OJK through access to FinTech Peer to Peer lending services. Through its "UMKM Go Digital" program, it is expected to strengthen MSMEs access to marketing, payment, and electronic-based financing services.

3. The Yogyakarta branch of Bank Indonesia has held several events under the banner "UMKM Go Digital". For instance, one program designed to improve MSMEs' capacity to use e-commerce, e-financing, and e-payment services was joined by MSME actors.

Higher education

Institutions of higher education in Yogyakarta have also participated in the digital ecosystem of the Special Region of Yogyakarta. Some institutions have provided mentoring and training services. Others have held workshops on using digital media, the process involved, and (due to the importance of media content in digital marketing) the basics of photography.

Community

The community in DIY is open to the programs initiated and implemented by the government and corporations, as well as digital service-based movements.

Collaboration

Several of the constituent elements of the MSME digital ecosystem have also worked in conjunction. For example, the Kampung UKM Digital program was implemented by the Bantul Regency government in conjunction with PT Telkom Indonesia. This program sought to empower MSMEs by encouraging the use of digital technology to support comprehensiveness and efficiency in business practices. Another collaboration, this one between the government and local financial services such as the Local Government Bank (Bank Pemerintah Daerah, BPD), was designed to educate MSMEs about finance.

Based on these data, several subsystems have resonated with the move towards digitalization. Resonance can be recognized based on how MSMEs, government, and other elements respond to the complex process of digitalizing MSMEs in DIY, either directly or through the media networks used in program implementation. This is more easily understood based on [Table 1](#).

[Table 1](#) shows the different stimuli within the MSME digital ecosystem, an information environment that has been observed to have formed a new and autonomous subsystem. This information environment ensures that all stimuli have the means of understanding themselves and their environments. Each subsystem produces elements in its system and still refers to the elements with their respective codes. The digital-based MSME sub-system category is identified through political, economic, and education codes. The codes are described in a binary scheme that all interpenetrations are under the conformity and deviation schemes. It allows each code to resonate with one another. In addition, it appears that the economic sub-system is a stronger power compared to the other sub-systems.

The Future of the MSME Digital Ecosystem

MSMEs' changing situation in the digital ecology has significant consequences and challenges, including unequal internet access, limited infrastructure coverage, and low levels of digital talent capabilities (National Information and Communication Technology Council, 2020). In the case of DIY, although the total number of MSMEs has continued to increase, only a tiny number of enterprises have used digital technology for marketing and production activities. Inequality still occurs, and some MSMEs are still experiencing setbacks.

At the same time, competition to enter the digital world is increasingly fierce, which means that digitalization efforts continue to be plagued by limited

knowledge, business interactions, technology, resources, and user abilities. Per an interview with the Department of Cooperatives and MSMEs (November 2021), MSMEs fall into three categories: (1) MSMEs whose business governance is still weak; (2) MSMEs whose business management is middling; (3) MSMEs who are already quite good at managing their business and quickly adapting to technological advances. According to government data, 98.80 percent of MSMEs in DIY fall under the first category; the second and third categories, meanwhile, encompass only 0.69 percent and 0.02 percent of MSMEs, respectively.

At the same time, the ongoing COVID-19 pandemic has wrought various challenges since it began in late 2019. As noted by Zutshi et al. (2021), this situation has created uncertainty for MSMEs and their continued business operations. The pandemic has limited interactions and physical activities, thereby digitalization provides MSMEs with a good means of economic recovery. Furthermore, as protective measures implemented for the community have necessitated the development of digital skills (Serpa et al., 2020), new digital tools may be adopted to improve MSMEs' business resilience. The digital transformation of MSMEs continues to be idealized as the solution for MSMEs to enter the Industrial Revolution 4.0 era.

It is nonetheless important to recognize that some MSMEs have quickly embraced digitalization, using information and communication technology for their business activities. This can be seen, for example, in (1) MSMEs' use of internet networks to access digital platforms such as Instagram, YouTube, and Facebook; (2) MSMEs' increased amount of product content uploaded; (3) MSMEs' increased sales; (4) MSMEs' establishment of partnerships and consumer outreach programs to increase demand for their products; (5) MSMEs' ability to develop local and national market networks and reach international markets. Several instances are provided in [Table 2](#) below.

Table 1 Responses within the MSMEs Ecosystem

Element	Response		Subsystem
Government	Central Government	Indonesia's economic vision, "The Digital Energy of Asia"	Political
	Local Government	Kampung UMKM Digital, SiBakul, and Desa Preuner	Political
Micro, Small, Medium Enterprises	Main local business actors in the Special Region of Yogyakarta	Increasing awareness amongst MSMEs actors and willingness to adapt to environmental changes	Economic
	Corporations	Financial Services Authority (OJK)	Encourages MSMEs to access FinTech Peer to Peer Lending for business development
Telkom Indonesia		Partnership to expand internet access	Economic
Bank Indonesia		UMKM Go Digital, capacity building activities	Economic
Higher Education	State Universities	Training and workshops	Education
	Private Universities	Training and workshops	Education

Source: Observation and primary data (2021)

Table 2 Internet Usage by MSMEs

MSME Name	Uploaded product content	
Kelompok Disabilitas	20 products	60 products
Difabike	10–15 per month	5–10 per day
Batik Sembung	4–5 pieces of content per day	> 9 pieces of content per day
Cokro Sulam Jetis	Rarely uploaded content	Frequently uploaded content
GD Case Fashion	10 pieces of content per month	One piece of content a day, routine
Kecap Sang Surya	Once a week	Everyday
UKM Ibu Yayuk	10 pieces of content per month	9 pieces of content per day

Source: Department of Communication and Information Technology of DIY (2021)

Table 2 shows the efforts made by MSMEs to realize resilience and sustainability by developing systems and organizing internal boundaries and structures. The usage of communication technology is observed to be part of their autopoietic system for self-defense.

This development is expected to enable MSMEs to weather social and economic changes in their community. The participation of diverse elements, including MSMEs, government, corporations, higher education institutions, and the community, is essential for a healthy digital ecosystem. Each element should be integrated and synergize to form a unified and dynamic ecosystem, as illustrated in Figure 1.

Figure 1 shows the relationship between elements in building digital-based SMEs in DIY. A sustainable digital ecosystem can be realized when each element interacts and collaborates, including MSMEs, government, corporations, higher education institutions, and the community. Through collaboration, efforts to

build a digital-based MSME ecosystem will be more effective and efficient. Besides, as part of the autopoietic system, communication technology has an essential role in building a digital ecosystem. It can be a tool to move every element towards sustainable development.

Discussion

Any society must respond to and overcome everyday life challenges (Bobylev et al., 2018). Inequality amongst MSMEs is one of the complexities associated with the environment’s response to digitalization, and the autopoietic system is observed to have the potential to reconcile mitigate issues. This system responds to the environment by producing and reproducing itself for survival and sustenance, a process that Mingers (2002) argues has imbued the system with a significant level of autonomy since it does not depend on other entities to maintain its existence sustainably.

The development of digital-based MSMEs in the MSME sector in DIY has in fact, created various gaps in terms of inequalities in the ability to use media, unequal access, inadequate infrastructure, and several other limitations. Sub-systems continue to evolve to increase system differentiation by building capacity through reproduction of system elements. Functional systems that are present from every element of the system, whether political, economic, or educational, are present to reduce environmental complexity. The system relies on its ability to develop a specific code in response to the challenge of adapting to the environment. The social system is observed whenever an autopoietic connection is made to communicate and differentiate the system from its environment.

Digitalization discourses have caused reactions, in the form of resonance, within the social system. This resonance supports the argument that the system includes a process of adaptation from within, or autopoietic. Responses to the digitalization of MSMEs have come

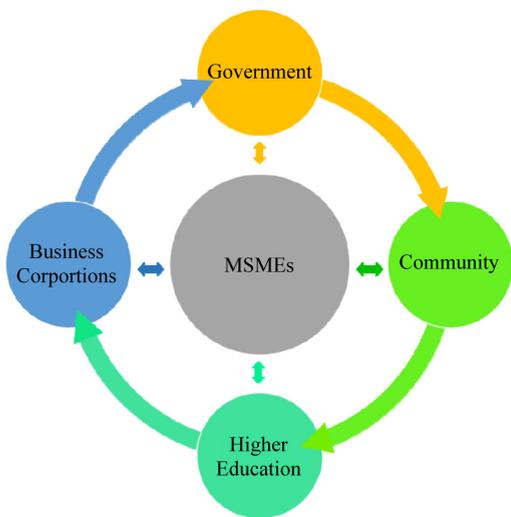


Figure 1 The involvement of MSME elements in DIY

Source: Author’s Analysis (2022)

from the government, MSMEs themselves, and other elements, such as banks, and higher education institutions, which represent the political, economic, and educational subsystems. As an autopoietic system, it is hoped that the MSME digital ecosystem will be able to lead to sustainable development. The present subsystems are a form of adaptation to environmental changes. Each subsystem in the MSME system in DIY reproduces its elements, where the system itself is open and closed to its environment. In Luhmann's perspective, communication is described as how each system interacts with its environment. It can be explained as how the system utilizes the power of the digital ecosystem to manage the sustainability development of digital-based MSME.

The Power of the Digital Ecosystem

The evolution of MSMEs in DIY is continuously evolving to encourage a more adaptive system, from the 'MSMEs go digital' movement launched by the Indonesian government in 2016 to the launch of Indonesia's economic vision in 2020, "The Digital Energy of Asia". The evolution toward digital transformation is increasingly visible in 2020, the development of MSMEs in the Special Region of Yogyakarta became increasingly dynamic as online communications and transactions increased due to the policies implemented to control the COVID-19 pandemic. Several online services were developed for both marketing and virtual electronic transactions. Moreover, business owners were encouraged to become technology literate and collaborate with business partners to digitize. Digitalization, thus, became increasingly prevalent following the beginning of the COVID-19 pandemic in Indonesia in March 2020.

This shift to using digital platforms for marketing coincided with a significant reduction or complete layoff of workers, again due to the COVID-19 pandemic, which created dangerous downturns in the economy. Data from the Yogyakarta branch of Bank Indonesia indicate that approximately 70 percent of MSMEs in DIY experienced reduced sales turnover in 2020, with some enterprises even closing. This was exacerbated by restrictions on education and tourism—the area's primary economic drivers—which severely reduced incomes throughout the province. Conventional transactions were also increasingly limited by social distancing policies. MSMEs thus had to embrace digital technology to remain productive and competitive, as reflected in [Table 2](#).

Digital technology can contribute significantly to sustainable development, impacting people's lives. It enables them to access real-time information, fosters transparency, brings equality and opportunities for participation, and contributes to several aspects of life. Moreover, digitalization promotes innovation in MSMEs' products, processes, and strategies. New business models that use technology to connect people, organizations, and resources in interactive ecosystems allow new value to be created (Parker et al., 2016). As shown by the digital-based MSME ecosystem in DIY, digitalization allows for a wide range of interactions between MSME actors and the consumer market. The resonance between subsystems encourages the system's evolution to become more adaptive and makes it possible to achieve sustainable development, especially for the MSME sector.

The Digital Ecosystem: Towards Sustainable Development

According to the MSME system code, the development of digital-based MSMEs aims to achieve community independence and welfare, so sustainability is needed in the future. So far, sustainable digital MSMEs have led to the monitoring and improvement of everyday life (Ordieres-Meré & Remón, 2020). Digitalization helps MSMEs overcome the challenges of the network era, such as climate change, increasing inequality, and demand for a safe and sustainable future. Moreover, the perspective of digital innovation has provided a support system for sustainable development, innovation, and competitiveness amongst MSME actors.

As indicated by this study, reliance on the autopoietic system clearly shows the involvement of the community, especially MSME actors. This is related to sustainable development, as outlined by the SDGs, which hold that community-based engagement is essential to building climate action and achieving development goals. The involvement of citizens in the process facilitates planning, governance, and the mobilization of social actors for sustainable development. Moreover, there is increased recognition that subject communities should participate in determining the right solution and ensuring sustainability. This is in line with the findings of Vipada and Deebhijarn (2018), that the community is significant in achieving business goals and ensuring competitiveness in the global market. Even in the case of DIY, support from the government and stakeholders is integrated into the digital ecosystem.

Kardos (2012) stated that successful sustainable innovation is accomplished when MSMEs achieve

a competitive advantage, such as economic success, by implementing innovative environmental and social practices. Due to their recognition as drivers of innovation and competitiveness, MSMEs are seen as critical to achieving sustainable development. Cooperation between actors, as seen in the digital MSME ecosystem in DIY, is essential for achieving sustainable development in the future.

Conclusion and Recommendation

Although a fully digitalized life is not all about technology, technology is nonetheless significant for societal survival. MSMEs have distinctive characteristics, with some lagging in adopting digital technology due to a lack of investment in knowledge-based assets and others having switched to digital platforms to survive the challenges of the Industrial Revolution 4.0, which is believed to have the capacity to scale up operations for environmental sustainability and sustainable development.

Some of the influencing factors for adoption are internal, such as interest, ability to accept technological innovation, and knowledge capacity/skills to access digital technology. Other factors are external. Aside from the government, participation also comes from corporations, and academics, all of which provide stimuli for MSMEs to continue creating a digital ecosystem for sustainable development. These stimuli provide the information environment needed by MSMEs to respond to the demands of the digital era. Through autopoietic, these enterprises ensure their survival and continued adaptation to changes in the system's structure and functionality. At the same time, it is also essential to highlight organizational learning mechanisms and knowledge sharing as means of keeping development on track and ensuring that all changes and transformations lead to sustainable development.

This study advances on stimuli and responses of the system of digitalization of MSMEs. It also explains the reasons why the development programme goes digital, the resonance of the system, and the sustainable development. Another limitation is the autopoietic concept used to analyze the study. This approach identifies the system in response to the environment in a partial context. Even so, the system itself is a unit of elements that are collected and organized arbitrarily

The findings of the study will be of immense benefits to the government and MSME actors, considering the fact

that the digitalization process is still ongoing along with the development programs of MSMEs in DIY. These findings could also serve as an aid for crafting strategic planning guidelines for the government.

Finally, the study recommends future researchers to implement it in another area of study. Further, the future studies should also focus on identifying an interrelation between subsystems involved in the development communication study in other geographic settings and other contexts. Considering that there will be various demands in different regions, a broad landscape is needed to describe the digital ecosystem in the context of developing MSMEs. Besides, the present study can act as baseline data for future research on relevant themes.

Conflict of Interest

The authors declare that there is no conflict of interest.

References

- Ahmad, S. Z., Bakar, A. R. A., Faziharudean, T. M., Zaki, K. A. M. (2015). An empirical study of factors affecting e-commerce adoption among small- and medium-sized enterprises in a developing country: Evidence from Malaysia. *Information Technology for Development*, 21(4), 555–572. <https://doi.org/10.1080/02681102.2014.899961>
- Bausch, K. C. (2015). Luhmann's social systems: Meaning, autopoiesis, and interpenetration. In *International Encyclopedia of the Social & Behavioral Sciences* (pp. 390–395). Elsevier. <https://doi.org/10.1016/B978-0-08-097086-8.32201-2>
- Boylev, S. N., Chereshnya, O. Y., Kulmala, M., Lappalainen, H. K., Petaja, T., Svetlana S. V., ... Tynkkynen, V. (2018). Indicators for digitalization of sustainable development goals in PEEEX Program. *Geography, Environment, Sustainability*, 11(1), 145–156. <https://doi.org/10.24057/2071-9388-2018-11-1-145-156>
- Bogavac, M., Prigoda, L., & Cekerevac, Z. (2020). SMEs digitalization and the sharing economy. *MEST Journal*, 8(1), 36–47. <https://doi.org/10.12709/mest.08.08.01.05>
- Braojos, J., Benitez, J., & Llorens, J. (2019). How do social commerce-IT capabilities influence firm performance? Theory and empirical evidence. *Information & Management*, 56(2), 155–171. <https://doi.org/10.1016/j.im.2018.04.006>
- Creswell, J. W., Cheryl, N. P. (2018). *Qualitative inquiry & research design: Choosing among five approaches* (4th ed.). Sage Publishing.
- De Berranger, P., & Meldrum, M. C. R. (2000). The development of intelligent local clusters to increase global competitiveness and local cohesion: The case of small businesses in the creative industries. *Urban Studies*, 37(10), 1827–1835. <https://doi.org/10.1080/00420980020080441>
- Department of Communication and Information Technology of DIY. (2021). *Laporan program internet untuk pemberdayaan masyarakat* [Report of internet program for community

- empowerment]. Government of the Special Region of Yogyakarta Province.
- Dini, P., Iqani, M., & Mansell, R. (2011). The (Im)possibility of interdisciplinarity: Lessons from constructing a theoretical framework for digital ecosystems. *Culture, Theory and Critique*, 52(1), 3–27. <https://doi.org/10.1080/14735784.2011.621668>
- Durand, F. (2017). Evolution, reproduction and autopoiesis. *HTS Teologiese Studies/ Theological Studies*, 73(3), 1–8. <https://doi.org/10.4102/hts.v73i3.4726>
- Fitriasari, F. (2020). How do small and medium enterprise (SME) survive the COVID-19 outbreak? *Jurnal Inovasi Ekonomi*, 5(2), 53–62. <https://doi.org/10.22219/jiko.v5i3.11838>
- Hagberg, J., Sundstrom, M., Egels-Zandén, N. (2016). The digitalization of retailing: An exploratory framework. *International Journal of Retail & Distribution Management*, 44(7), 694–712.
- Hajli, M. N. (2014). The role of social support on relationship quality and social commerce. *Technological Forecasting and Social Change*, 87, 17–27. <https://doi.org/10.1016/j.techfore.2014.05.012>
- Herrera-Vega, E. (2015). Relevance of N. Luhmann's theory of social systems to understand the essence of technology today. The case of the Gulf of Mexico oil spill: *Para Alberto. Technology in Society*, 40, 25–42. <https://doi.org/10.1016/j.techsoc.2014.08.005>
- Hynes, B. (2016). *Going digital in the small firm – Is it all about technology!!!* DIGA - Digital Innovations for Growth Academy.
- Kardos, M. (2012). The relationship between entrepreneurship, innovation and sustainable development. *Procedia Economics and Finance*, 3, 1030–1035.
- Koskinen, K. U. (2013). Observation's role in technically complex project implementation: The social autopoietic system view. *International Journal of Managing Projects in Business*, 6(2), 349–364. <https://doi.org/10.1108/17538371311319061>
- Lee, D. (2000). The society of society: The grand finale of Niklas Luhmann. *Sociological Theory*, 18(2), 320–330.
- Li, W., Badr, Y., & Biennier, F. (2012). Digital ecosystems. *Proceedings of the International Conference on Management of Emergent Digital EcoSystems - MEDES '12* (pp. 117–122). ACM Digital Library. <https://doi.org/10.1145/2457276.2457297>
- Luhmann, N. (1989). *Ecological communication*. Chicago University Press.
- Luhmann, N. (1992). Autopoiesis: What is communication?. *Communication Theory*, 2(3), 251–259. <https://doi.org/10.1111/j.1468-2885.1992.tb00042.x>
- Luhmann, N. (2004). *Ökologische Kommunikation Kann die moderne Gesellschaft sich auf ökologische Gefährdungen einstellen?* [Ecological communication Can modern society adapt to ecological threats?]. VS Verlag für Sozialwissenschaften/ GWV Fachverlage GmbH. <https://doi.org/10.1007/978-3-663-05746-8>
- Luhmann, N. (2013). *Introduction to systems theory*. Polity Press.
- Lumanauw, N. (2021, June 10). *Dorong UMKM Masuk Ekosistem Digital, Pemerintah Terapkan Strategi Jemput Bola* [Encouraging MSMEs to enter digital ecosystem, government implements pick-up strategy]. <https://www.beritasatu.com/ekonomi/785345/dorong-umkm-masuk-ekosistem-digital-pemerintah-terapkan-strategi-jemput-bola>.
- Mingers, J. (2002). Can social systems be autopoietic? Assessing Luhmann's social theory. *Sociological Review*, 50(2), 278–299. <https://doi.org/10.1111/1467-954X.0036>
- Nambisan, S., Wright, M., & Feldman, M. (2019). The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes. *Research Policy*, 48(8), 103773. <https://doi.org/10.1016/j.respol.2019.03.018>
- National Information and Communication Technology Council. (2020). *Transformasi digital untuk UMKM*. [Digital transformation for MSMEs]. <http://www.wantiknas.go.id/id/berita/transformasi-digital-untuk-umkm>
- Ordieres-Meré, J., Remón, T. P., & Rubio, J. (2020). Digitalization: An opportunity for contributing to sustainability from knowledge creation. *Sustainability*, 12(4), 1460.
- Paetau, M. (2013). Niklas Luhmann and cybernetics. *Journal of Sociocybernetics*, 11(1/2), 75–103. https://doi.org/10.26754/ojs_jos/jos.20131/2790
- Parker, G. G., Marshall, W., & Van Alstyne, S. P. C. (2016). *Platform revolution: How networked markets are transforming the economy and how to make them work for you*. W. W. Norton & Company.
- Qureshi, S. (2015). Are we making a better world with information and communication technology for development (ICT4D) Research? Findings from the field and theory building. *Information Technology for Development*, 21(4), 511–522. <https://doi.org/10.1080/02681102.2015.1080428>
- Regional Development Planning Agency (Badan Perencanaan Pembangunan Daerah). (2020). *Pengentasan Kemiskinan Daerah Istimewa Yogyakarta* [Poverty alleviation in the Special Region of Yogyakarta]. <http://bappeda.jogjapro.go.id/dataku/infografik/kemiskinan>.
- Reis, J., Amorim, M., Melao, N., Cohen, Y., & Rodrigues, M. (2020). *Digitalization: A literature review and research agenda*. In Z. Anisic, B. Lalic, & D. Gracanin (Eds.), *Proceedings on 25th International Joint Conference on Industrial Engineering and Operations Management* (pp. 443–456). Springer. https://doi.org/10.1007/978-3-030-43616-2_47
- Ritzer, G. (2011). *Sociological theory* (8th ed.). McGraw-Hill.
- Riviera, E. (2013). Scientific communities as autopoietic systems: The reproductive function of citations. *Journal of the American Society for Information Science and Technology*, 64(7), 1442–1453. <https://doi.org/10.1002/asi.22826>
- Rodger, J. J. (2021). Luhmann's theory of psychic systems and communication in social work practice. *Journal of Social Work*, 22(3), 637–654. <https://doi.org/10.1177/14680173211008107>
- Serpa, S., Ferreira, C. M., José Sá, M., & Santos, A. I. (2020). *Digital society and social dynamics*. Services for Science and Education-United Kingdom. <https://doi.org/10.14738/eb.17.2020>
- Servaes, J., Emily, P., Shi, S., Reilly, D., & Yakupitijage, T. (2012). Towards a framework of sustainability indicators for 'communication for development and social change' projects. *The International Communication Gazette*, 74(2), 99–123.
- Servaes, J. (2016). How 'sustainable' is development communication research?. *International Communication Gazette*, 78(7), 701–710. <https://doi.org/10.1177/1748048516655732>
- Shivam, G. (2019). *How digitalization is supporting sustainable development*. <https://www.globaldev.blog/blog/how-digitalization-supporting-sustainable-development>
- Statistics Indonesia. (2021, February 15). *Persentase Penduduk Miskin September 2020 naik menjadi 10,19 persen* [The percentage of poor people in September 2020 rose to 10.19 percent]. <https://www.bps.go.id/pressrelease/2021/02/15/1851/persentase-penduduk-miskin-september-2020-naik-menjadi-10-19-persen.html>
- Valenduc, G., & Vendramin, P. (2017). Digitalisation, between disruption and evolution. *Transfer*, 23(2), 121–134. <https://doi.org/10.1177/1024258917701379>
- Valentinov, V., Roth, S., & Will, M. G. (2018). Stakeholder theory: A Luhmannian perspective. *Administration & Society*, 51(5), 826–849. <https://doi.org/10.1177/0095399718789076>
- Vanderstraeten, R. (2012). Rewriting theory: From autopoiesis to communication. *Systems Research and Behavioral Science*, 29(4), 377–386. <https://doi.org/10.1002/sres.2116>
- Vipada, S., & Deebhijarn, S. (2018). Community-based enterprise (CBE) export performance strategy: An analysis of Thailand's entrepreneurial OTOP program. *Asia-Pacific Social Science Review*, 18(1), 91–110. <https://www.dlsu.edu.ph/research/publishing-house/journals/apssr/volume-18-number-1/>

- Wahyuni, H. I. (2019). Ecological communication in information society: Reflections on Niklas Luhmann's thought in understanding ecological & disaster issues in Indonesia. *Jurnal Komunikasi: Ikatan Sarjana Komunikasi Indonesia*, 4(1), 9–17. <https://doi.org/10.25008/jkiski.v4i1.270>
- Wu, W., & Parkvithee, N. (2017). Promoting international competitiveness for small and medium-sized enterprises (SMEs): A case study of Chinese SMEs in Thailand. *International Review of Management and Marketing*, 7(3), 320–330. <https://search.proquest.com/docview/1984678393?accountid=63189>
- Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Sage.
- Zutshi, A., Mendy, J., Sharma, G. D., Thomas, A., & Sarker, T. (2021). From challenges to creativity: Enhancing SMEs' resilience in the context of COVID-19. *Sustainability*, 13(12), 6542. <https://doi.org/10.3390/su13126542>