BARRIERS TO ICT ADOPTION BY SMEs IN INDONESIA: HOW TO BRIDGE THE DIGITAL DISPARITY?

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Abstract: The use and utilization of ICT for SMEs attract the attention of many parties. The problems of SMEs in Yogyakarta, Indonesia that is so diverse cannot be simplified on the issue of technology adoption. Moreover, increasing competitiveness is necessary so that ICT can truly be a bridging digital disparity. The action research activity is carried out to close the gap which not only focuses on understanding the pattern of technology adoption alone but also involves action steps in helping SMEs to survive and able to compete. The results showed that the SMEs still had difficulty in utilizing ICT from the upstream side. This is triggered by the limitations of existing human capital in managing technical and operational aspects of ICT. Therefore, the strategies to use of ICT for SMEs is recommended to combine a proactive and reactive approach so that the optimization of resources will be achieved. Accordingly, we suggest that further studies apply the implementation of ICT on proactive and reactive actions to close the knowledge gap between the two in a different setting, context, location, and/or culture.

Keywords: ICT adoption, uniqueness of SMEs, digital disparity, Indonesia


Small and Medium Enterprises (SMEs) are now recognized worldwide to be a key source of dynamism, innovation, and flexibility in advance industrialized countries, as well as in emerging and developing economies. They are responsible for most net job creation and make important contributions to innovation, productivity, and economic growth. SMEs, in the USA, account for three out of every four new jobs and contribute to providing over half of the gross domestic product. SMEs have increased the competitive intensity of the market
and encouraged the development of entrepreneurial skills and innovation (Todd and Javalgi, 2007).

However, critical to the growth, survival and subsequent development or creation of sustainable competitive advantage of SMEs, is the inclusion and integration of information and communication technology (ICT) into their business operations. SMEs which have implemented ICT have seen its impact on their overall competitive position. The accrued benefits derived from the use of ICT far outweighed the costs and challenges associated with the investment (Sharma and Bhagwat, 2006).

Issues regarding the adoption and diffusion of innovations based on ICT among SMEs have grown considerably and are shifting. The classic issue of adoption initially put forward the sophistication of technology for efficiency through simplification of business processes, now its orientation has shifted to a more complex direction towards increasing competitiveness and resilience through the formation of global networks and alliances. ICT is a catalyst for sustainable development by strengthening global interconnection facilities; accelerate the progress of nations through productive economic activities; and bridging the digital divide phenomenon through the development of a knowledge-based society.

Reducing digital disparity through the expansion of public literacy regarding the use and use of ICT is a precondition for strengthening resilience to realize the life of civil society. That means that the direction of public policy at the macro level definitively drives the emergence of new economic behavior in society that is in harmony with technological advances supported by good corporate governance.

Meanwhile, literature studies at the micro-level of the organization consistently continuing to raise classic themes and highlight the role of ICT-based innovation in transforming organizational strategy (Kappelman et al., 2020). That means, the use and use of ICT as an enabler factor at the organizational level, especially for small, and medium-scale enterprises, is suspected of being able to transform ways of generating added value, and the magnitude of the strategic benefit generated. At the same time, the adoption of ICT among SMEs also raises its organizational challenges which are quite complex, especially in managing the stimulation process of operational activities which in turn impact on achieving the level of efficiency, effectiveness, and competitiveness of businesses (Shailer et al., 2000).

The new values expected to emerge in the formulation of technology-based innovation strategies have a central role in efforts to build global competitiveness achieved by SMEs through the development of product innovations, process innovations, and institutional innovations. All of that certainly requires its escort, especially if the innovation process that is carried out is related to the implementation of public policies that lead to; (1) easing the space for freedom of creation and innovation in the digital economy era; (2) exploring the benefits of information and communication technology in a fair, and sustainable manner in the community; and (3) the impact of community behavior while maintaining sovereignty in the life of the nation and state.

Based on these developments, exploration studies need to be carried out to address various contextual challenges and at the same time as an effort to reduce the research gap which has so far only relatively focused on macro policy objectives in the digital economy era. Empirical studies using relevant research action methods are carried out as a way to address the problems and contextual uniqueness of SMEs in Indonesia. By understanding the pattern of adoption and diffusion of innovation, action steps can be formulated as a form of problem-solving support to accelerate the rate of growth and productivity of SMEs.

That means, that action research activities are not only limited to helping create a marketplace but more than, which is continuing to encourage SMEs to survive and compete by developing creativity and innovation on an ongoing basis. Specifically, the exploratory study carried out is expected to be able to present empirical evidence about how ICT plays a strategic role as a guide to promoting SMEs growth and is oriented towards competitiveness.

In terms of public policy, the results of this empirical study are expected to provide constructive input on innovation strategies, and optimization
of patterns of utilization of information and communication technology resources for increasing SMEs productivity and economic growth in Indonesia. The ability to observe patterns of adoption, and then implement appropriate mentoring models is part of the answer to the complexity of the models, and strategies for developing SMEs. This empirical study will base on interdisciplinary arguments: economics, business, social, design, and techniques in exploring a variety of perspectives to meet the need to accelerate SMEs. With the involvement of experts who explore various critical issues by taking cases in various fields, the study conducted in this study is expected to be able to provide insights that are deep and comprehensive so that they are useful for the parties involved.

This exploratory study focuses on the pattern and formulation of SMEs development strategies with the use of ICT as an enabler factor, including the identification of several aspects related to human capital development as the main factor that facilitates and inhibits the diffusion and adoption of innovations among business actors; mastery of technical aspects; and aspects of connectedness in global business networks.

Furthermore, this study also explores the effectiveness of the implementation of organizational activities as a consequence of management decisions and the SMEs in adopting ICT-based innovations. An assessment of the strength of influence shown by the innovative ability of business actors in utilizing policy support, the ability to manage business activity networks, and the interaction of SMEs with managers of educational institutions as well as incubation agents and other innovations can be maintained. The relationship between one entity with another entity is an opening key element in filling the blanks of human resources who have relevant competencies and sufficient self-resilience.

Concerning the existing contextual situation, the critical questions in this study are: How do the innovative capabilities of SMEs, as demonstrated by the level of ICT knowledge among owners, the level of ICT investment awareness, and the clarity of organizational strategies coherently play a role in the development of SMEs? How do government policies related to accelerating the process of ICT adoption and diffusion facilitate the pace of growth and development of SMEs? How do SMEs utilize existing connections with educational or research institutions and other change agents to accelerate the growth and development of business activities?

LITERATURE REVIEW

Increasing and strengthening the capacity of innovation is a strategic issue for SMEs in Indonesia to be able to continue to grow and be sustainable in a disruptive era. Strengthening innovation capacity is achieved through the fertilization of productive resources and integrative capabilities as a form of organizational responsiveness to environmental change (Muljono et al., 2017). This indicates the need for SMEs to prepare themselves in the form of human capital with the provision of relevant skills and competencies to respond to changes in business models triggered by the adoption of technology-based innovations (Dam, 2019). The application of technology-based innovation then transforms organizational processes by disrupting various types of work and the scope of productive activities carried out conventionally.

Historically, disruptive innovation is an anomaly in the mastery of technology and efforts to meet changing market needs (Christensen et al., 2017). It requires preconditions that should be responded to proportionately so that the behavioral changes that occur do not cause excessive confusion and expectations of technological sophistication and organizational management practices. The sophistication of technology, which is interpreted as an enabler factor, enables business actors to overcome the obstacles of distance, time, and place in facing competition. For SMEs, the use of technology-based innovation as a key tool in the formulation of competitiveness is a “luxury” of its own, even though it has unwittingly become an important part of the organization’s life in dealing with environmental conditions that are full of uncertainty.

In a situation where SMEs have various resource constraints, the formulation of strategies for competitiveness and resilience should ideally be carried out gradually, beginning with increasing the
self-sensitivity of business actors in interpreting every change and then continuing with the courage to take anticipatory steps with risks measured. A proactive attitude in decision making supported by adequate data and analytical capabilities for SMEs actors certainly increases bargaining power to stakeholders. That is why the level of speed of SMEs in decision making has become increasingly relevant to the public’s push so that the role of SMEs as a bumper in maintaining national economic stability can be realized and then play a role as an actor for digital economic growth.

The SMEs can play an important role in the national economy of developing countries. The adoption of ICT has enabled local SMEs to participate in international markets. However, little research has addressed the issues associated with SMEs adopting ICT, especially in rural areas of Saudi Arabia. It was reported that relative advantage, top management support, culture, regulatory environment, owner/manager innovation, and ICT knowledge have a significant effect on ICT adoption among SMEs in Saudi Arabia (AlBar and Hoque, 2019).

Furthermore, the presence of SMEs in the context of economic development occupies a central position to reduce the possibility of volatility over the elements forming gross domestic income (GDP) through employment and increase the volume of activities that encourage consumption and investment growth in the real sector. Data from the Economic Census conducted by the Central Statistics Agency 2019, there were 64.19 million business units included in the SMEs category in Indonesia. From the number of business operators in that category, the amount of contribution to GDP was 61.07% or IDR 8,573 trillion by absorbing 97% of the total workforce. Meanwhile, in terms of investment contributions, SMEs contribute 58.18% of the total national investment. Regarding the potential strengths of SMEs and the magnitude of their contribution to the national economy, observing the pattern and development of innovation strategies has its urgency to carry out. The adoption and diffusion of information and communication technology are suspected to be a guiding factor that makes SMEs more competitive. In detail, the flow of argument exposure in this literature review is structured as follows: innovation initiatives among SME actors and the urgency of SMEs to adopt a basic framework of technology-based innovation to support competitiveness.

**Innovation Initiative**

The awareness of SMEs in utilizing information technology documentation reflects a positive signal for strengthening the innovation ecosystem. Data released by the Coordinating Ministry for Economic Affairs in 2017, shows that there are more than 4.7 million SMEs who have used digital technology for business interests in various formats (e-commerce and marketplace platforms). The growth of business actors is predicted to continue to grow with a variety of incentives in the form of accelerating public services in facilitating the growth of business activities. Even so, the role of SMEs in promoting export activities is still relatively limited. The contribution of SME exports is only around 15.7% of the total non-oil exports in this country.

Several factors that have been identified as obstacles in developing competitiveness and resilience include mastery of technology and innovation, human capital capacity, compliance with legal aspects, access to funding and market sources, and creative power for product development and service. Apart from the limitations inherent in the SME group, the current macro conditions indicate that there are open gaps and potential for development to accelerate productive economic growth by relying on ICT-based innovation.

One loophole that can be exploited by SMEs is to increase their absorptive capacity for innovation. The flexibility that characterizes SMEs in decision making can be used as a strength to explore innovation opportunities that are based on sources of knowledge from outside the organization. Lichtenthaler (2011), revealed that the absorptive capacity or absorption of knowledge about technology and markets is a precondition needed to initiate innovation and improve the quality of organizational learning. Organizational creativity in responding to environmental changes is an absorptive step and at the same time adaptive behavior that is generally owned by SMEs groups in innovating.
Absorptive capacity is an exploration of the power of absorption of external knowledge through sequential processes ranging from exploratory, transformation, and exploitation of learning resources to create excellence for organizations. The relevance for the formulation of SMEs development strategies is that the process of selecting arenas and the phasing of the use of information technology as a contributing factor is crucial in bringing about product innovation, process, and institutional aspects. The sectoral uniqueness inherent in SMEs is very likely to signal the need for a variety of arena innovations and not completely follow a single linear path. This means that there is diversity in the flow of the innovation process and its phases in initiating and further developing infrastructure to support the strengthening of innovation capacity.

The diversity of the innovation process flow indicates the unique behavior of SMEs, especially in absorbing external knowledge for innovation and organizational development. Cultural compatibility, for example, is now an important element and is a key characteristic in absorbing innovation in the creative industry, especially in the field of fashion and the development of digital application devices. Thus, mastery of external sources of knowledge, especially regarding technological sophistication and market behavior, is believed to be the foundation for SMEs in initiating innovation. Strengthening the capacity to absorb knowledge possessed can also be a stimulant for SMEs in exploring innovation opportunities such as synchronizing activities to take advantage of innovation policy support, developing business activity networks, and efforts to improve the quality of interactions with educational institutions and other incubation agents. Strengthening the innovative capacity of SMEs, as demonstrated by the level of ICT knowledge among owners and managers, the level of ICT investment awareness, and the clarity of the organization's strategy can coherently play a role in the process of developing the capacity of external knowledge absorption for SMEs development.

**The Urgency of Adoption of ICT-Based Innovations**

The basic framework for adopting technology-based innovation refers to the flow in the process of eliminating the results of product innovation, which starts from the idea, conceptualization, prototype development, market acceptance testing, to the final utilization stage which impacts on increasing economic value for users. That is why the ability of SMEs in orchestrating sources of innovation and then linking them to meeting the needs of the public to gain benefits from these innovations is an urgent matter to be studied in depth. Synchronizing SMEs activities with government policy priorities related to accelerating the process of ICT adoption and diffusion has its weight to boost the pace of growth and development of productive businesses. The ability of SMEs to take advantage of opportunities and linkages with innovation centers and other change agents is deemed necessary to be developed to accelerate the growth and development of business activities.

Literature review at the micro-level of the organization has consistently raised classic themes and highlighted the role of ICT-based innovation in transforming organizational strategies (Kappelman et al., 2020). The use and use of ICT as an enabler factor in an organizational context is believed to be able to transform ways to produce added value and launch strategic benefits. At the same time, the adoption of ICTs among SMEs raises organizational challenges especially in the process of stimulating operational activities which in turn impacts on achieving the level of efficiency, effectiveness, and competitiveness of businesses (Shailer et al., 2000).

The pattern of adoption illustrates the logical path that has been adopted by business actors in orchestrating productive resources and innovation opportunities. An understanding of adoption patterns is a relevant issue in determining strategic priorities and allocation of resources for organizational development. The main key lies in being able to look at adoption patterns and then implement appropri-
ate mentoring models in response to the complexity of the SME development model. This empirical study bases on interdisciplinary arguments: economics, business, communication, design, and technique in exploring various perspectives and the need to accelerate SMEs. With the involvement of experts who explore critical issues from a variety of different fields, the exploration of this study is expected to provide deeper and comprehensive insights that are useful for relevant public policy-makers.

The development of business activities carried out with the support of ICTs in principle follows the management process flow. ICT can provide the potential to be creative and open up new opportunities that can support the efficiency and effectiveness of the business activity. However, the form and model of ICT application cannot be compared between one activity and another business activity.

METHOD

In this case, we use applied research, a research methodology used to solve a specific, practical issue affecting an individual or a group. It is also used to quantify how well science can be applied to solve real-life problems (Christensen et al., 2017). The author uses this method to apply the strategy of using ICT to SMEs. This research accommodates the possibility of the dynamics of the SME context that occurs during the study process. Therefore, action research was selected and used in this study to provide space and flexibility in observing problems at the practical level in the field and then to develop patterns and actions for technology-based strategic innovation for business development needs. Furthermore, to answer the basic questions raised in this study, the multiple case studies method is used to strengthen the argument and reveal in-depth by explaining the uniqueness of the sectoral context and alternative development strategies. By considering the inherent limitations in the approach and method of study, the selection of observed objects, sources, duration of observation, and the degree of attachment to the object during the research process has its urgency to obtain the expected results while answering study questions. The precautionary principle is applied in every step to reduce the effects of bias that might occur in the application of multiple case studies.

The choice of SMEs engaged in the agricultural sector and the creative economy in the Special Region of Yogyakarta with the consideration that the SMEs can survive more than 5 years since it was founded. The selection of SMEs and assistance was carried out from June to November 2019.

The standard procedures to be taken to carry out action research include (a) Pre-survey and at the same time mapping of ICT facilitation in the target area of study by involving cross-sectoral experts; (b) Workshop and Focus Group Discussion to formulate a change and development agenda; (c) Initiating change by providing treatment as an incentive for the development of SMEs activities both offline and online; (d) The mentoring or mentoring process is carried out to increase technical and managerial capacity; (e) The introduction of innovations carried out with school activities or field studies is carried out as mobilizing the community in creating and generating constructive ideas for business development.

In this study, the business sectors that are the focus of attention are agro-business, and creative industries (crafts and fashion). The observation field represents sectoral uniqueness, the potential of regional excellence, the level of business maturity, and the readiness of business actors in adopting technology-based innovations. The readiness of business actors in adopting technology is a process of change that requires separate oversight at each stage. The mastery of detailed aspects of ICT use is carried out by escorting technical aspects; while the process of optimizing the use of technology in business units requires guarding managerial aspects.

The development and acceleration of business activities carried out with the support of ICTs in principle follows the management process flow. ICT can provide the potential to be creative and open up new opportunities that can support the efficiency and effectiveness of the business activity. However, the form and model of ICT application cannot be compared between one activity and another business activity. The implication is that public policies related to ICT development for SMEs also cannot
be single and apply to all. Specifically, the functions and roles of ICTs can be divided into the following stages:

Efficiency, at this stage, ICT is still seen as a tool to help improve efficiency in business activity. The adoption of technology is carried out to simplify business processes and support the smooth operation of business operations. The form of implementation of this stage is the use of ICT for office management, the use of software to replace manual processes, the preparation of ICT-based reports, to the development of web sites to complete the business transaction processes that occur.

Effectiveness, in this second stage, ICTs are not just interpreted on the surface, but start to get a more central role. In this case, ICT is not only a tool for managing offices but has been used to help achieve business goals more effectively. The form of implementation activities at this stage is the use of ICTs to maintain sustainability and establish relationships with customers (customer relationship management) or other strategic partners. ICT applications at this stage can also be carried out to increase competitiveness and resilience in doing business through continuous improvement of the product quality assurance process. The introduction of the use and utilization of internet applications of things, as well as the application of sensor technology in the agro field, is part of an effort to control quality from the stage of material selection, production process, to post-production.

Competitiveness, at this stage, ICT plays a very important and strategic role in a business. ICTs become more interactive. The ICT strategy must be aligned and in line with the business strategy. In this case, ICT is utilized in various aspects of business activities such as mapping consumer behavior, making market modeling, compiling sensitivity analyzes, building more interactive product designs, and building global business networks. For this third stage to be realized, at least 3 (three) main prerequisites are needed: ICT assets (infrastructure), ICT knowledge (human resources), and ICT relationships (connectivity). Adequate ICT infrastructure can be capitalized maximally to optimize its utilization. Good ICT-based human resources can enhance capabilities and encourage better adaptation in line with changing business and global markets. The development of a harmonious ICT ecosystem is expected to be able to support good interaction and mutually reinforcing networks between and various entities involved.

RESULTS AND DISCUSSION
Utilization of ICT and Mentoring Patterns

The mentoring process on the object of study that includes technical and managerial aspects is done by first considering the level of readiness and potential of each object of study in utilizing ICT to improve business performance. The casuistic phenomena found in each case that are the object of study are not interpreted as achieving the level of SMEs authentication in adopting technology, but rather describing the uniqueness of the object of study which requires special caution if it intends to generalize to a broader scope. Multiple case studies are conducted to explore sectoral, managerial, and social interaction uniqueness that affect the capacity of SMEs in adopting technology-based innovations.

The selection of objects is done by first considering the location, duration of time, and criteria for SMEs to have the urgency of being the object of study. In this study, the selection of SMEs activities in the Special Province of Yogyakarta, which was also partially carried out by a comparative study of several SMEs in several districts, was based on the argument that the potential supporting resources for the development of SMEs in the region share a contextual similarity even though each region has characteristics and patterns. Alone. Comparative studies, although carried out partially, are also needed to examine the consistency of the technology adoption process among SMEs. Moreover, the diversity of SMEs behavior that is triggered by historical factors, business scale, business ownership, and business maturity suggests the need for an introduction to the diversity of the process of adoption and oversight of activities in the use of technology-based innovations.

As a buffer for the national economy, the readiness of SMEs for the use of technology is a must,
especially for business activities oriented to the global market. The existence of SMEs occupies a strategic position because a number of their activities are a mainstay to support economic growth in the digital age. Business sectors that are the mainstay of economic development include the tourism industry, agro-industry, clothing, handicrafts, and other creative industries. The sectoral diversity that exists in SMEs is indeed seen as an element of power formation, but at the same time, it can also trigger strategic challenges in determining resource development priorities. Attention to local creativity that is supported by a strong production base and support for the availability of skilled labor is the basic capital to take steps to make constructive efforts to increase the productivity of SMEs.

To obtain an overview of the object of study, the selection of participants is carried out by considering aspects of compatibility and readiness in adopting and the potential use of ICT to support the progress of business activities. The selected participants in this study are business activities that have started productive activities and are recommended by peer groups. Determination of participants was also carried out based on the precautionary principle of the validity of the database and categorization of SMEs. The final selection of business units for the object of study is also determined based on the results of the initial mapping and discussion carried out together with representatives from the local government to ensure that the selected SMEs already have or adopt ICTs and are eligible for more specific mentoring programs.

Consideration in determining the object of study is the readiness and capacity of the SMEs unit in optimizing the availability of ICT infrastructure to support improved organizational performance. The initial indication used is to invite owners and/or managers to discuss the potential and direction of technology optimization and innovation for business sustainability. The acquisition of knowledge with a different way of thinking, but still constructive in the role of adoption and diffusion of technology-based innovations is a consideration of developing organizational capacity. Access to every value creation opportunity through constructive thought synergy. That is, the formation of SMEs behavior that is based on new values and organizational culture that is adaptive to change and even able to shape the environment. The ability to adopt innovation naturally varies between SME units and is a unique phenomenon to be discussed in a case study. Orientation on the use of ICT for each group of SMEs will be described in the following case study subsections.

Case Study: Smart Farming Application

The application of technology in agriculture is time to be urgently applied as an effort to mitigate the risk of losses that may arise due to climate change and soil quality degradation. Alternative efforts by applying controlled environment methods are expected to help increase productivity and reduce the risk of production failure. Future agriculture is certainly very dependent on the application of modern technology with the capacity to increase the scale, efficiency, and effectiveness of production and shipping in all aspects of the commodity value chain.

Climate change is a major consideration in the design, improvement, and adoption of sustainable agricultural technology in the future. The intensification of sustainable agriculture is intended to produce more yields from existing land and reduce negative environmental impacts, while at the same time increasing the contribution of ecological balance.

A breakthrough solution to the challenges that occur in agriculture with the application of relevant technology is smart agriculture (smart farming). The farming system seeks to increase productivity by regulating the proportion of energy supply from both solar sources and a controlled soil fertility management process. Fertility has a meaning as a continuous capacity to function according to its potential and changes from time to time due to its use. Maintaining soil fertility is only possible in situations where investment returns (land, labor, and inputs) are improved, proper soil management (including the use of the right tools), utilization of soil organic matter, proper fertilization or maintenance, and reducing the excessive use of pesticides. Meanwhile, water needs need to be minimized through the application of...
smart agriculture, plant cultivars with cropping systems, and integrated technology able to increase the efficiency of water use to the extent necessary.

At a higher level, after the data has been collected will be processed in an intelligent algorithm to provide better knowledge of the production process that takes place in real-time, then make reasoning from the current situation and make predictions based on heterogeneous input data, then generate early warnings about the potential hazards that threaten cultivars, and increase the automatic control signal of plant response (Kacira et al., 2005). The algorithm needed to handle data in real-time is run locally on the Wireless Sensor Network (WSN) node. However, in the IoT context, all objects will be interconnected, and therefore computing overhead can be easily transferred to cloud computing or distributed to connected devices.

**IoT Application Model For Screenhouse**

IoT and technology can be used for monitoring and control in the form of engineering for example for watering, liquid fertilization, and humidity increase that work automatically based on intelligent algorithms from the analysis of observed environmental conditions. In this case, all key parameters that can be used to describe the conditions being experienced by melon plants through the use of sensors that are connected online and in real-time will be responded mechanically in the form of fogging, watering, and fertilizing following the specified threshold. Several tools needed to implement the Smart Farming Hikapel application in limited land schematically are presented in the following figures.

The factors that affect the production of Melon include the following: Seed quality is one of the keys to getting planting that gives optimal results. Quality seeds are seeds from pure varieties with a high percentage of germination, free from pests and diseases, and with the right moisture content. The main factors that determine seed quality are seed purity and germination rate. Especially for Hikapel melon seeds, they have been carefully managed to obtain uniform quality seeds.

Soil fertility is a quality value of the ability of the soil to provide nutrients for the growth of a type of plant in adequate and balanced quantities. Soil fertility will affect crop production and yield. This is the basis for the need for treatment for temperature, humidity, pH, and soil EC must be adjusted appropriately to obtain optimal conditions for plant growth. IoT application with control on irrigation and fertilization using a drip system is expected to provide optimal conditions and cost-efficiency.

The provision of organic material and inorganic fertilizers (N, P, and K) is an attempt to meet the nutrient requirements for plants. With a wirelessly controlled drip system, it can be used optimally and economically in terms of administering the right dose of fertilizer. Of course, the level of dosage must be based on the results of the analysis using continuously monitored data. Besides, it is also necessary to prune the leaves because the results of photosynthesis that are not distributed to the leaves are used to form flowers or fruit.

Each plant has its suitability for climate and weather. Climate is determined by the condition of the altitude of the plain above sea level, while the weather determines the ambient temperature. Both of these factors also affect pests and diseases that may arise. By using a screen house, the weather conditions can be controlled, by setting the temperature of the air or the environment. When it is known that the optimal temperature for melon plants, the control can be done by using some mechanization such as blowers or water spray. Both of these tools can be installed in the right location and function automatically following the commands of the IoT connected control device.
Melon plant growth requires a suitable growth environment to provide high yields. The good growth environment is 50-70% humidity, the average temperature ranges from 25-30°C with rainfall 1500-2500 mm per year. Installation of IoT for melon cultivation in this greenhouse uses several sensors for web-based monitoring and control. The analysis is based on data collected to find out: 1) Soil pH, Electrical Conductivity (DHL), light intensity, soil moisture, volumetric, and soil temperature. 2). Environmental engineering carried out is irrigation and fertilization. Fertilization is based on results of the analysis of soil nitrate content and power electrical conductivity. Fertilization and irrigation are done if there is a decrease in soil moisture content and nitrate in low nitrate concentrations.

The results of the assistance in this study indicate that the growth environment of melon plants planted in greenhouses can be monitored properly and can be done in detail through wireless sensors. The results of temperature monitoring through installed sensors show temperatures inside the greenhouse vary between 31°C to 58°C ground, and between 23°C to 43°C, air humidity ranges from 31-97%, and light intensity reaches 62669 lumens during the day. While the results of monitoring the soil moisture show the value of 24-26% (v/v) and 31-33% (v/v), the results of soil conductivity monitoring show values of 0.15-0.18 dS/m², and 31-53 dS/m², soil temperature varies between 25-41°C and 28-37°C. Soil acidity does not provide accurate data. Plant growth between the fields applied by IoT and those without IoT shows the same growth data based on plant height, number of leaves, and stem diameter below. It can be concluded that the given IoT treatment did not interfere with melon growth.

In this research, soil temperature has fluctuated very wide, which is 25 - 40°C. The lowest temperature is reached at night, while the high temperature is reached during the day. Wide temperature fluctuations are not favorable for plant growth. A high and uneven DHL value was also found between locations. Meanwhile, soil pH is not well monitored, but soil moisture is monitored well, even though the moisture value is below the good value for plant growth.

**Case Study of Creative and Digital Industrial Communities**

The creative and digital industry community is unique and complex in terms of development and interaction patterns of activities. Industrial growth is still relatively limited and not yet fully capable of quantum leap and is still relatively conventional. The availability of Co-working space which is facilitated by various parties has not yet fully functioned as an ideal designation, relatively limited as “Play working space”. That is why the growth of creative and
digital industries does not fully follow the linear flow in the development of business activities. The creative spirit of the founders has not yet been fully followed by collaborative steps that can produce added value.

SMEs tend to operate in a fragmented and sporadic manner. There are more than 140 SMEs engaged in the creative and digital fields in Yogyakarta. The majority have 5-19 employees, followed by 20-99 employees, most of whom were established in 2015 so that what is currently available tends to be more mature. The central issues faced by digital creative industry players are geographical concentration, talent scouting, technical skills, soft-skills, mentoring, and escorting the innovations. The pattern of development of innovation in the creative and digital sectors can be pursued in a variety of ways which in essence is an increase in the capacity of human capital.

Availability of idle capacity can be used as a place for the development of digital and creative SMEs. This is in line with the problems faced by SMEs today: frequent blackouts, difficulty in getting workspace, no office hours, etc. Some SMEs expressed concern that they would copy each other’s designs or take the talent from one another. This can be controlled through community-based social control. In that way, the final results can be directed to build cooperation and synergy between community members. This is similar to the findings of AlBar and Hoque (2019), which states that the adoption of ICT has enabled local SMEs to participate in global markets, gain a relative advantage, gain top management support, create a better culture, create a bargaining power against regulators, and encourage owner/managers innovation. All of these can be seen in Saudi Arabia where ICT adoption has a significant effect among SMEs.

Funding problem: There aren’t many angel investors in this region. There are no funding sources such as trust funds. The mechanism of seed funding and funding without collateral is necessary. In other words, a strong ecosystem to support the elimination of digital-based innovation is still relatively limited. More than that, a strong leadership pattern is needed to dilute the ego of digital business people and reduce the disparity between digital business people so that the acculturation process is well realized.

Mentoring Pattern Discussion

Observation during the mentoring process of a number of SMEs that were the object of study indicated a number of problems with the readiness of business actors to adopt and further utilize ICTs to increase business productivity: (a) readiness to adopt technology is closely related to the maturity of business activities and awareness of business managers in developing their business strategies; (b) the application of the pattern of technical assistance and/or managerial assistance is determined by the sectoral uniqueness and the prospect of SMEs to be the drivers of productive economic activities on a large scale; (c) the orientation of the use and utilization of ICT for the field in the creative industries at this initial stage is more focused on the downstream side (to support marketing activities, distribution, and public awareness), while for the upstream side, especially relating to cultivation, use and utilization ICTs are aimed at increasing productivity through work efficiency.

The diversity of ICT usage patterns among SMEs found in the object of this study illustrates that business actors do not follow a linear path in adopting technology-based innovations. This means that increasing business productivity cannot be fully facilitated by the use of ICT without taking into account the readiness and contextual uniqueness that exists in each business sector. As a consequence, the pattern of assistance is varied starting from unstructured patterns to structured patterns.

Based on observations obtained several interesting findings related to the use of information and communication technology in the environment of SMEs in the Yogyakarta Special Region. First, in general information and communication technology has been used by SMEs. However, the patterns and levels of usage are very diverse. Second, the types of industries that utilize ICT are not uniform. The majority use this technology to expand market access (promotion and marketing), not yet to touch on business processes in each of the existing indus-
tries. This indicates that technical assistance and managerial assistance are necessary to shift the use of technology from merely pursuing efficiency to effectiveness and building competitiveness.

Other findings obtained from this study are that there have been several SMEs coaching activities initiated by other institutions and institutions, such as GoDigital, Digital Village, and so on. Some sectors such as souvenirs, clothing, and processed foods appear to have been able to show an independent brand and packaged in good packaging. Such a sector by itself has been able to go online and directed to pursue higher competitiveness.

CONCLUSIONS

Adoption and diffusion of ICT-based innovation is a social process that weights “art” greater than “science” in managing change. The characteristics of innovation perceived by business actors as something that has relative advantages can be observed, compatibility with existing business practices, controlled level of complexity, and the ability to be trialed are preconditions that enable SMEs to use and utilize ICTs for the benefit of increasing productivity and the sustainability of its business activities.

Based on the observation, and escorting of the mentoring process in various business groups, this empirical study revealed a variety of patterns of use and utilization of information and communication technology-based innovations among SMEs. This reinforces the initial argument that the uniqueness and diversity of the sectors inherent in the activities of SMEs require special escort according to the field of work and the level of maturity of business actors in adopting ICT-based innovations.

Different from the general pattern, the practice of utilizing ICT among SMEs moves from the downstream to the upstream side. That is the use and use of ICTs to build public connectivity that reaches across geographical and demographic boundaries accelerate the literacy of business actors regarding technological sophistication even with varying degrees of understanding.

Therefore, the strategy formulation in the utilization of information and communication technology in SMEs is ideally able to combine a “proactive” and “reactive” approach. A proactive strategy, taking into account existing sectoral uniqueness, can be adopted for the development of SMEs that aim to expand the range of market segments served; meanwhile a reactive approach can be taken to help SMEs maintain their position and strengthen their capacity to face competition in the market segments served. In business groups based on digital creativity, the application of proactive strategies gives greater opportunities to maintain the sustainability of their businesses.

RECOMMENDATIONS

Strategic alliances of innovation centers that have been scattered in various forms of institutions or work units are very possible to be realized to optimize productive resources. Strengthening the capacity of institutional interaction between sources of innovation will encourage the realization of collaborative efforts through collaborative activities in the teaching industry format which leads to productive economic activities.

For this purpose, it is time to bring up a new pattern for accelerating the productivity of SMEs through a combination of technical and managerial mentoring patterns. The need for facilitation of assistance that is semi-structured or even structured is quite urgent to be fulfilled so that the scarcity of human resources which is a key element in the use of ICT-based innovations can be fulfilled within an adequate timeframe.

Finally, strengthening the capacity of SMEs to innovate is a collaborative effort involving a variety of stakeholders which all lead to improving the socio-economic well-being of the community. The power of ICT will in turn be largely determined by the ability of the productive economic sector to manage the operations process and deliver the results of its innovation from upstream to downstream.

Therefore, the strategies to use of ICT for SMEs is recommended to combine a proactive and reactive approach so that the optimization of resources will be achieved. As mentioned, we strongly suggest that further studies apply the implementation of ICT on proactive and reactive actions to close
the knowledge gap between the two in a different setting, context, location, and/or culture.

REFERENCES


