Optimizing Information and Communication Technology (ICT) to Build Competitive Advantage for Batik Craftsmen

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Abstract

ICT implementation is the application of information technology carried out in business to improve performance, maintain sustainability and gain competitive advantage. ICT implementation in this study is ICT infrastructure, ICT management and ICT proactive. ICT implementation in this study emphasizes the commitment to invest in information technology software and hardware. Then synergize ICT with its business processes. This study uses a quantitative approach, with a sample of 280 batik craftsmen in East Java, Indonesia. Data were obtained by distributing questionnaires, and 264 questionnaires were returned and considered suitable for use as research data. Data were analyzed statistically with SEM PLS. The independent variables in this study are ICT infrastructure, ICT management, ICT proactive and ICT implementation and the dependent variable is competitive advantage. The results of the study found that there was a positive and strong relationship, both for direct and indirect relationships. ICT implementation provides positive and significant support as a moderator in the relationship between ICT infrastructure, ICT management, ICT proactive and competitive advantage. ICT implementation also has a positive and significant direct effect on competitive advantage. ICT is currently not only considered, but should be implemented for batik craftsmen for competitive advantage.

I. Introduction

The business environment is currently experiencing dynamic changes in all business fields. This condition is caused by increasingly tight competition. Business actors are competing to find new ways to optimize their business processes in winning the competition, thus creating a new paradigm shift from transactional marketing to relationship marketing, which was originally product-oriented to customer-centric. (Qosasi et al., 2019). Focus on consumers because consumer behavior is changing rapidly, and it should be answered by business actors quickly too (Nikmah et al., 2024). Consumers expect businesses to be adaptive, especially with technology. The existence of consumer behavior that has partly shifted to online shopping, makes shopping not only served offline, but producers must also provide online shopping services.

No exception for batik craftsmen as small and medium-sized enterprises (SMEs). They must implement digital transformation. Digital transformation refers to the process and strategy of using digital technology to change the way businesses operate and serve customers (Yusuf et al., 2023). Yusuf et al (2023) stated that digital technology is one of the triggers for the emergence of opportunities that can be utilized by batik craftsmen.

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These opportunities can be something that will change one or more aspects (business models, operational models, customer experience, etc.)

In this study, digital transformation is referred to as information and communication technology (ICT). ICT for batik craftsmen as SMEs can be a value creation. ICT can affect the ability to improvise and competitive advantage in the business environment. Disruption due to the development of ICT requires batik craftsmen to implement it. This arises as a result of market needs that are not only product-based but also based on market needs (Nikmah et al., 2020). ICT captures the ability for companies to adapt faster to external changes than their competitors (Jared, Orwa, & Oloko, 2015), thus giving them a sustainable competitive advantage (Jared, Orwa, & Oloko, 2015). Today's business is not only chasing sales targets, but managing how the business is sustainable is more important (Nikmah, Rahmawati, Sukma, 2021). Batik craftsmen must think about this too. Amidst the fierce competition of batik craftsmen, it is difficult to determine competitive advantage. Having a competitive advantage means being able to create greater economic value than that implemented by competitors (Liu & Fang, 2016). One of the indicators that is used as capital for competitive advantage for batik craftsmen is ICT.

Therefore, having ICT capabilities is intended to achieve or maintain a company's competitive advantage (Teece & Leih, 2016); (Nikmah et al., 2021). ICT is a set of tools used by an organization to produce, process, and disseminate information (Qosasi et al., 2019). Currently, small businesses are required to have dynamic capabilities to respond to market changes, shorten product cycles, and change or redirect consumer demands (Uden, 2007). In conditions like this, small business organizations must be faster, more flexible, and participatory (Sussan & Johnson, 2003) and faster, sharper, and more resilient (Wang & Ahmed, 2007).

II. Review of Literature

2.1 ICT and Its Relevance to SMEs

ICT refer to a range of technologies that collect, manipulate, store, and distribute information (Yuwono, Suroso, & Novandari, 2023). These technologies include technologies such as the internet, telecommunications (mobile phones and landlines), wireless networks, digital broadcasting, and other digital technologies that transmit and manipulate information in various formats. This technology has become an essential element of business operations, facilitating organizations to function more efficiently, expand into new markets, and enhance communication and information exchange (Kossai & Piget, 2014); (Kashorda & Waema, 2011).

Small and medium enterprises (SMEs), it is important to consider the importance of information and communication technology (ICT). The application and utilization of ICT by SMEs plays a significant role in improving their performance and competitiveness, especially in a global economy, where market success often depends on technological competence (Azam, 2015). Information and communication technology (ICT) enables SMEs to optimize their operations, reduce costs, and improve their ability to adapt to market fluctuations (Yuwono, Suroso, & Novandari, 2023). ICT can also empower them to engage in competition on a wider scale, accessing untapped markets and clients through e-commerce and online advertising.

Several studies have demonstrated a significant relationship between ICT and benefits for SMEs. A study conducted on Tunisian SMEs in the electrical and electronics industry has shown that effective application of ICT can have a significant impact on profitability (Kossai & Piget, 2014). ICT to SMEs can foster creativity, stimulate

expansion, and empower SMEs to compete with greater efficiency on a domestic and global scale (Yuwono, Suroso, & Novandari, 2023). ICT is essential for SMEs to enhance their role in economic development, and ensure their long-term growth and competitiveness in the global market (Vidhyalakshmi & Kumar, 2016).

2.2 Competitive Advantage

Competitive advantage is the application of strategies to achieve the goals of reducing costs, exploiting market opportunities, and neutralizing competitive threats (Newbert, 2008). Competitive advantage is the advantage of a business in presenting the value of a product or service that is superior to competitors' products and provides benefits to customers (Armawan, Mukhlis, & Murwani, 2023). Competitive advantage of a business is defined as the ability to achieve economic benefits by obtaining greater profits than its competitors in the same market and industry.

Competitive advantage requires a comprehensive picture of business and competitor advantages (Puspaningrum, 2020), because competitive advantage comes from various different activities, such as product-related areas (Leonidou et al., 2015), market characteristics (Carbone et al., 2020), service quality (Johnson & Sirikit, 2002), distribution (Hoffman & Novak, 1996), and marketing ecosystems (Zhang & Watson IV, 2020). Competitive advantage can be measured in various ways, such as production capacity, marketing capacity, product quality, pricing advantage (Katsikeas, 1994), and innovation and cost leadership (Chandler & Hanks, 1994). The competitive advantage of SMEs can be seen from the uniqueness of their products, product quality, and competitive product prices (Song & Parry, 1997).

In business competition, SMEs are also required to think creatively in building their businesses and dare to innovate to create different and superior products compared to competitors (Yusuf et al., 2023). SMEs as creative businesses are able to produce innovations for competitive advantages that are the main capital for SMEs to survive in an increasingly competitive market. This means that SMEs have the potential and opportunity to develop their competitive advantages. SMEs that are flexible in running their businesses, are not rigid and easy to follow trends, are easier to achieve competitive advantages (Nikmah et al., 2020). This is an advantage that is not possessed by large companies, which are always surrounded by standard rules and procedures.

2.3 Theoretical Framework

The theoretical framework is a conceptual model that describes the relationship between factors that influence each other. The theoretical framework in this study is:
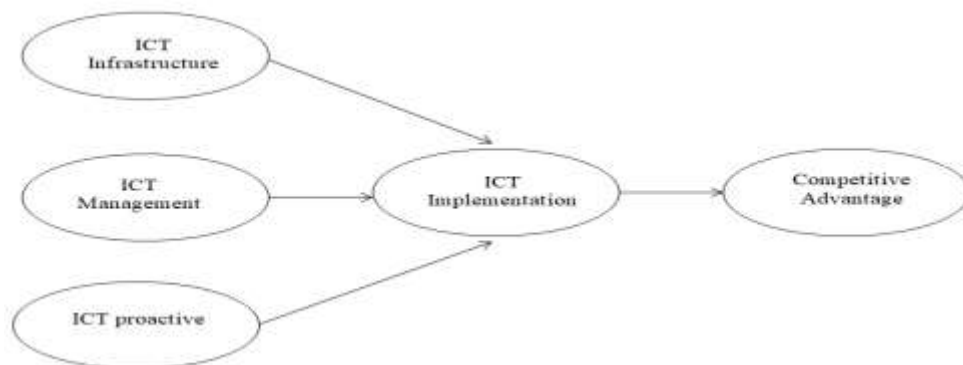

Figure 1. Theoretical Framework

2.4 Theoretical Framework
a. ICT Infrastructure and ICT Implementation

ICT infrastructure is more about the availability of application/software facilities and information technology/hardware needed in an ongoing business (Qosasi et al., 2019). ICT infrastructure is a prerequisite for sustainable ICT implementation. It can also provide an enabling environment to enhance problem solving and collaboration (Ntorukiri, Kirugua, & Kirimi, 2022). Other studies have mentioned the importance of the availability of basic infrastructure facilities needed for ICT implementation. Such as a Very Small Aperture Terminal (VSAT) for internet access in a computer lab is an infrastructure that is considered vital for the implementation and success of ICT because of its value for simple communication capabilities (Nyagowa, Ocholla, & Mutula, 2014). So the hypothesis is:
Hypothesis 1: There is a positive influence of ICT infrastructure on ICT implementation.

b. ICT Management and ICT Implementation

ICT management focuses on two things, first on making business plans and information technology plans that are used in an integrated manner, and second on understanding the importance of investing in information technology (Qosasi et al., 2019). Every organization requires good and proper management. Good management is needed for all types of activities in an organization, both large and small. Management techniques are also developing rapidly. New knowledge and techniques give rise to new discoveries, thus creating an environment that allows work to be completed efficiently and provides previously unimaginable satisfaction. Likewise, the development of information and technology that is increasingly advanced has an impact on the increasing need for information in society. Investment in ICT has a significant impact on its implementation. Showing good management. Moreover, if ICT planning is integrated with the core business being run, it will form a good ICT implementation as well (Suryadiningrat, Wahyudin, & Sobandi, 2023). So the hypothesis is:
Hypothesis 2: There is a positive influence of ICT management on ICT implementation.

c. ICT Proactive and ICT Implementation

ICT proactive emphasizes on things that continue to innovate in ICT, build a supportive climate to try new ways of using ICT, always increase the effectiveness of ICT use (Qosasi et al., 2019). ICT proactive is an action that is always moving and dynamic to increase the benefits of ICT. ICT is used to maintain the continuity of ongoing business. There is awareness from business people so as not to lose by investing in ICT, so that ICT is maximized, to build a more efficient way of working. So the hypothesis is:
Hypothesis 3: There is a positive influence of ICT proactive on ICT impelementation

d. ICT Implementation and Competitive Advantage

ICT implementation is more about efforts to be able to combine resources and capabilities to reduce operational costs to a more effective level than competitors; able to combine resources and capabilities to defend oneself from various existing competitive threats; able to combine resources and capabilities to take advantage of opportunities more comprehensively than competitors; trying to find ways to stay ahead of the competition; recognized as superior in identifying opportunities in the market compared to competitors (Qosasi et al., 2019). So the hypothesis is:
Hypothesis 4: There is a positive influence of ICT implementation on competitive advantage.

Hypothesis 5: ICT infrastructure has a significant effect on competitive advantage with ICT implmentation as mediator.

Hypothesis 6: ICT management has a significant effect on competitive advantage with ICT implmentation as mediator.

Hypothesis 7: ICT proactive has a significant effect on competitive advantage with ICT implmentation as mediator.

III. Research Method

Using a quantitative approach, and path analysis testing was carried out using the PLS test with Smart PLS software. Statements for the variables ICT infrastructure, ICT management and ICT proactive were adopted from Qosasi et al (2019), ICT implementation from Kashorda & Waema (2011), and competitive advantage from Qosasi et al (2019). The questionnaire was distributed to 280 respondents and 264 questionnaires were returned and considered suitable for use as research data. Respondents in this study were batik craftsmen throughout East Java, Indonesia. Based on the data, 87% of respondents were women, the remaining 13% were men. Most participants were in the age range of 35 to 60 years, with more than 7 years of work experience. The batik they are engaged in is hand-drawn, stamped, printed batik. The reason for choosing these respondents is because batik is a historical heritage, in addition to providing economic value for craftsmen, it also provides educational value for the community. Thus, batik needs to be preserved by adapting to technology in running its business.

IV. Result and Discussion

In this research, to test convergent validity, the outer loading parameter value is exceeding 0.5 and the average variance extracted (AVE) value is exceeding 0.5. Table 1 is the result of convergent validity testing.

Table 1. Convergent Validity Test

Variabel	Loading Factor	Standard Error	T Statistics	Result
ICT infrastructure	0.884	0.017	52.948	Valid
	0.934	0.008	110.427	Valid
ICT management	0.892	0.019	47.957	Valid
	0.929	0.010	91.572	Valid
ICT proactive	0.915	0.010	89.444	Valid
	0.867	0.027	31.681	Valid
	0.918	0.012	78.929	Valid
ICT implementation	0.886	0.018	48.744	Valid
	0.866	0.024	36.674	Valid
	0.836	0.027	30.650	Valid
	0.903	0.018	49.842	Valid
	0.874	0.022	39.984	Valid

	0.875	0.020	43.982	Valid
	0.891	0.015	60.707	Valid
Competitive advantage	0.929	0.011	82.931	Valid
	0.898	0.014	64.095	Valid
	0.865	0.023	37.686	Valid

Source: Data Processing Results (2024)

According to the findings from the analysis of the 1st order measurement model (as presented in table 1), It is evident that all indicators assessing ICT infrastructure, ICT management, and ICT proactive exhibit loading factor values exceeding 0.6. Thus the seven indicators are declared valid. The ICT implementation variable is measured by five indicators and all indicators exhibit loading factor values exceeding 0.6. Thus the five indicators are declared valid in measuring ICT implementation variables. The competitive advantage variable is measured by five indicators with all indicators exhibit loading factor values that exceed 0.6. Thus the five indicators are declared valid in measuring competitive advantage variables. Apart from looking at the outer loading value, convergent validity is also evident through the Average Variance Extracted (AVE).

Table 2 shows the AVE value of each construct above 0.5. All average variance extracted (AVE) values produce values exceeding 0.5. Thus the indicators that measure the variables of ICT infrastructure, ICT management, and ICT proactive, ICT implementation, and competitive advantage are declared valid.

Table 2. AVE Test

Variabel	AVE
ICT infrastructure	0.820
ICT management	0.800
ICT proactive	0.822
ICT implementation	0.763
Competitive advantage	0.795

Source: Data Processing Results (2024)

Subsequently, the discriminant validity will be assessed through testing. Table 3 is the findings of testing the discriminant validity of the constructs in this study by showing the cross loading value.

Table 3. Cross Loading Value

ICT infrastructure	ICT management	ICT proactive	ICT implementation	Competitive advantage
0.884	0.844	0.864	0.445	0.425
0.934	0.834	0.932	0.401	0.389
0.829	0.892	0.800	0.366	0.396
0.729	0.929	0.901	0.380	0.383
0.825	0.901	0.915	0.408	0.369
0.817	0.862	0.867	0.375	0.351
0.912	0.818	0.918	0.426	0.396

0.332	0.332	0.332	0.886	0.353
0.402	0.402	0.402	0.866	0.391
0.318	0.318	0.318	0.836	0.370
0.404	0.404	0.404	0.903	0.415
0.456	0.456	0.456	0.874	0.437
0.345	0.345	0.345	0.428	0.875
0.413	0.413	0.413	0.400	0.891
0.428	0.428	0.428	0.405	0.929
0.353	0.353	0.353	0.399	0.898
0.368	0.368	0.368	0.391	0.865

Source: Data Processing Results (2024)

Table 3 above shows the cross loading value of each item and the loading value in the intended construct surpasses the loading value of the other constructs. So, it might be assume that all constructs and indicators have met the parameters of the discriminant validity test, so that it can be said to be valid. It is also Inferred that all indicators have met the parameters of the discriminant validity test, and can be regarded as valid. Next, testing construct reliability as indicated by the value of composite reliability and Cronbach's alpha. As per the test criteria, if the composite reliability > 0.7 and Cronbach's alpha surpasses 0.6, the construct is deemed reliable. The summary of composite reliability and Cronbach's alpha calculations is displayed in the table 4 below, indicating the results:

Table 4. Reliability Test

Variables	*Composite Reliability*	*Cronbachs Alpha*
ICT infrastructure	0.970	0.963
ICT management	0.968	0.961
ICT proactive	0.960	0.953
ICT implementation	0.942	0.923
Competitive advantage	0.951	0.935

Source: Data Processing Results (2024)

By referring to the aforementioned table 4, it may be observed that the the value of composite reliability on the variables of ICT infrastructure, ICT management, and ICT proactive, ICT implementation and competitive advantage is exceeding 0.7. Consequently, considering the calculations of composite reliability, all indicators assessing ICT infrastructure, ICT management, and ICT proactive, ICT implementation and competitive advantage are affirmed to be reliable. Likewise, the value of cronbach's alpha on the variable ICT infrastructure, ICT management, and ICT proactive, ICT implementation and competitive advantage is exceeding 0.6. Hence, based on the calculations of Cronbach's alpha, all parameters measuring ICT infrastructure, ICT management, and ICT proactive, ICT implementation and competitive advantage are deemed reliable.

Furthermore, before arriving at the hypothesis test, a goodness of fit model test was executed. The aim is to assess the capacity of endogenous variables to account for the variations in exogenous variables, or in simpler terms, to gauge the level of contribution of exogenous variables to endogenous variables. The adequacy of the model fit in PLS analysis is evaluated through the utilization of R-Square and Q-Square predictive relevance (Q2). The outcomes of the goodness of fit model are outline in table 5 below.

Table 5. Goodness of Fit Model Result Test

Endogen	R Square
ICT implementation	0.196
Competitive advantage	0.270
$Q^2 = 1 - [(1 - R_1^2)(1 - R_2^2)]$	
$Q^2 = 1 - [(1 - 0.196)(1 - 0.270)] = 0.413$	

Source: Data Processing Results (2024)

Q-Square competitive advantage (Q2) is 0.413 or 41.3%. This suggests that the variability in competitive advantage can be accounted for by the overall model at a rate of 41.3%, meaning the contribution of ICT infrastructure, ICT management, and ICT proactive, ICT implementation on competitive advantage as a whole (direct and indirect influence) of 41.3%, whereas the remaining 58.7% can be attributed to other factors not explored in this research.The last test in this research is hypothesis testing which is utilized to examine whether there is a correlation between exogenous variables and endogenous variables. Criteria for testing expressed which if the coefficient of the path is positive and Tstatistic ≤ Ttable (1.96, with an alpha of 5%) or p value ≤ level of significance (alpha (α = 5%)) then there is a positive and significant effect between exogenous variables on endogenous variables. The outcomes of hypothesis testing are displayed in the table 6 below.

Table 6. Results of Testing the Direct Relationship Hypothesis

Endogenous	Exogenous	Path Coefficient	T Statistics	P Value
ICT infrastructure	ICT implementation	0.443	8.060	0.000
ICT management	ICT implementation	0.283	4.236	0.000
ICT proactive	ICT implementation	0.328	5.279	0.000
ICT implementation	Competitive advantage	0.432	7.799	0.000

Source: Data Processing Results (2024)

Testing the effect of ICT infrastructure on ICT implementation can be seen to produce a path coefficient of 0.443 and a Tstatistic of 8.060 with a p value of 0.000. The test outcomes indicate a positive path coefficient, with T-statistic exceeding the T-table value (1.96), or a p-value lower than the significance level (alpha = 5%). These findings signify a substantial impact of ICT infrastructure on ICT implementation, thereby confirming the acceptance of hypothesis 1 (H1).

The effect of ICT management on ICT implementation generates a path coefficient of 0.283 and a Tstatistic of 4.236 with a p value of 0.000. The test outcomes reveal a positive path coefficient, with the T-statistic surpassing the T-table value (1.96), or a p-value lower than the significance level (alpha = 5%). This indicates a positively and significantly correlation between ICT management and ICT implementation, leading to the acceptance of hypothesis 2 (H2).

The impact of ICT proactive on ICT implementation results in a path coefficient of 0.328, a T-statistic of 5.279, and a p-value of 0.000. The test outcomes demonstrate a positive path coefficient, with the T-statistic exceeding the T-table value (1.96), or a p-value lower than the significance level (alpha = 5%). These findings indicate there is a

positively and significantly impact of ICT proactive on ICT implementation. This indicate that it can be stated that hypothesis 3 (H3) is accepted.

The influence of ICT implementation on competitive advantage yields a path coefficient of 0.432, a T-statistic of 7.799, and a p-value of 0.000. The test outcomes indicate a positive path coefficient, with the T-statistic exceeding the T-table value (1.96), or a p-value lower than the significance level (alpha = 5%). This implies that there is a positively and significantly impact of ICT implementation on competitive advantage. As a result, hypothesis 4 (H4) is accepted. In addition to testing direct influence, indirect testing was also conducted. The following are the results of indirect testing that positions ICT implementation as a mediator.

Table 7. Results of testing the indirect relationship hypothesis

Eksogen	Intervening	Endogen	*Indirect Coefficient*	T Statistics	P Value
ICT infrastructure	ICT implementation	Competitive advantage	0.145	4.416	0.000
ICT management	ICT implementation	Competitive advantage	0.157	4.518	0.000
ICT proactive	ICT implementation	Competitive advantage	0.143	4.413	0.000

Source: Data Processing Results (2024)

The effect of ICT infrastructure on competitive advantage by ICT implementation generates a path coefficient of 0.145 and a Tstatistic of 4.416 with a p value of 0.000. The effect of ICT management on competitive advantage by ICT implementation generates a path coefficient of 0.157 and a Tstatistic of 4.518 with a p value of 0.000. The influence of ICT proactive on competitive advantage by ICT implementation generates a path coefficient of 0.143 and a Tstatistic of 4.413 with a p value of 0.000. All of these test outcomes indicate a positive path coefficient, with the T-statistic surpassing the T-table value (1.96), or a p-value lower than the significance level (alpha = 5%). Consequently, this signifies a positive and significant influence of ICT infrastructure, ICT management, ICT proactive on ICT implementation across competitive advantage.

The results of this study support the research of Kossai & Piget (2014); Qosasi et al (2019); Kashorda & Waema (2011) which stated that the elements in ICT implementation, such us ICT infrastructure, ICT management, ICT proactive, have an influence on competitive advantage. The results of the statistical test show that all research hypotheses are supported. ICT implementation of batik craftsmen has positively and statistically significantly influenced competitive advantage. ICT infrastructure has the greatest influence on competitive advantage. This means that the availability of software and hardware is important in the implementation of ICT. The commitment of batik craftsmen to invest in these two parts supports the smooth implementation of ICT. The investment made does not have to be expensive, they can do it part by part. Whichever comes first, that becomes the priority. Most batik craftsmen are trying to expand the market, with digitalization. They build websites, market places to compete with fellow batik craftsmen and large batik companies. Websites have a positive impact on the effectiveness of SME marketing (Thelwall, 2000); (Sugito, 2023).

ICT management emphasizes that the adoption of technology is integrated into organizational management. This integration is increasingly in demand across SMEs and is seen as part of the management portfolio. Integrated management systems are a series of

interconnected processes that use human, material, information, infrastructure, and financial resources to achieve sustainability strategies (Magd & Karyamsetty, 2020). ICT management has the lowest impact on competitive advantage. This proves that there are still few batik craftsmen who integrate technological needs into their business processes. Batik craftsmen actually know that technology is important to them, but they are not yet confident in being able to properly integrate it into their management. While ICT implementation has a 40% influence on competitive advantage. This supports research conducted by Qosasi et al (2019) that SMEs that have implemented ICT are easier to gain competitive advantage.

V. Conclusion

ICT implementation which includes ICT infrastructure, ICT management and ICT proactive has a strong influence on competitive advantage. Batik craftsmen should be brave in making decisions to invest in information technology. It doesn't have to be expensive, just on the most needed priorities for now, and then increase their investment per stage. Reengineering their business, to be integrated with information technology so that it is easy to adapt and follow every change that occurs. ICT must be implemented by batik craftsmen to win the competition, both with fellow batik craftsmen and with large companies. Furthermore, for business sustainability and to gain competitive advantage.

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