E-Agricultural Services and Business

Roles of Information Technologies for Small-scale Furniture Businesses

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Abstract— **Information and Communication Technology (ICT) is increasingly believed to be a powerful tool for facilitating business in a free trade era, creating a digital revolution. However, such a revolution can potentially hamper the desire to make globalisation work for all by expanding the digital divide; since many rural people do not have sufficient financial, physical and knowledge capital to access ICT. This paper presents our preliminary findings, in which we evaluate the application of ICT in facilitating small-scale furniture enterprises in Jepara District in Central Java, Indonesia, based on three main indicators: effectiveness, efficiency, and equity. We found that effective use of ICT for marketing was more determined by media placement than by media choice. Thus, a bombarding strategy which pervasively advertises products through all available online media is the most effective strategy. On the contrary, efficient use of ICT for marketing is more determined by media choice than by media placement. Thus, with limited capital, media choice is a more efficient strategy than media placement. In general, access to ICT is currently unequal. Without relevant policy interventions and initiatives, this inequity could increase due to the positive feedback loop that exists between ICT accessibility and wealth.**

Keywords-component; digital divide, furniture, information and communication technology, Jepara, small scale

I. INTRODUCTION

Disparity in global wealth distribution is caused by restricted access to information exchange (Stigler 1961, Constant *et al.* 1994, Stiglitz and Greenwald 1986). Winners and losers in life are determined by their relative access to information. Those having better access will have better opportunities in life. Thus, survival of the fittest really depends on information (Beinhocker 2006).

Advances in information and communication technologies (ICT) have enabled people all over the world to communicate and share information without any spatial obstacles, addressing the main cause of global wealth. The Internet and other communication technologies are important tools for adapting competition strategies in global economics. The Internet is becoming the foundation for new business models, processes and new ways of distributing knowledge (Laudon and Laudon 2000 in Anyasi and Imoise 2009).

ICT is increasingly believed to be a powerful tool for facilitating businesses in a free trade era, creating a 'digital revolution'. Participation in a global value chain using modern ICT will enhance the internationalisation and growth of small and medium enterprises (SMEs) as it provides access to global markets at costs lower than those faced by individual small-scale producers who would otherwise use traditional means and rely on contractors as intermediaries.

However, concerns have emerged that the 'digital revolution' could degrade the desire to 'make globalisation work for all' by creating another socioeconomic gap, termed the 'digital divide'. Just like 'business as usual', the victims would mostly be people living in rural areas, as they tend to lack sufficient financial, physical and knowledge capital to access ICT.

We took the furniture producing region of Jepara in Central Java, Indonesia as an example for looking at the possible digital divide in the application of ICT. The region is a complex urban and rural mix, and has many small- and medium-scale enterprises producing wooden furniture (Purnomo *et al.* 2009a,b). This paper presents our preliminary findings, and aims to map small and medium enterprises' use of ICT' in Jepara in order to evaluate its 'usefulness' based on three indicators: effectiveness, efficiency, and equity; as the basis for further in-depth studies.

II. METHODOLOGY

The main data in this study was collected through direct interviews with SMEs in Jepara. Considering the unique spatial distribution of furniture enterprises in region, which is a complex, agglomerated urban and rural mix (see Figure 1), respondents were selected based on location to ensure relatively even spatial distribution.

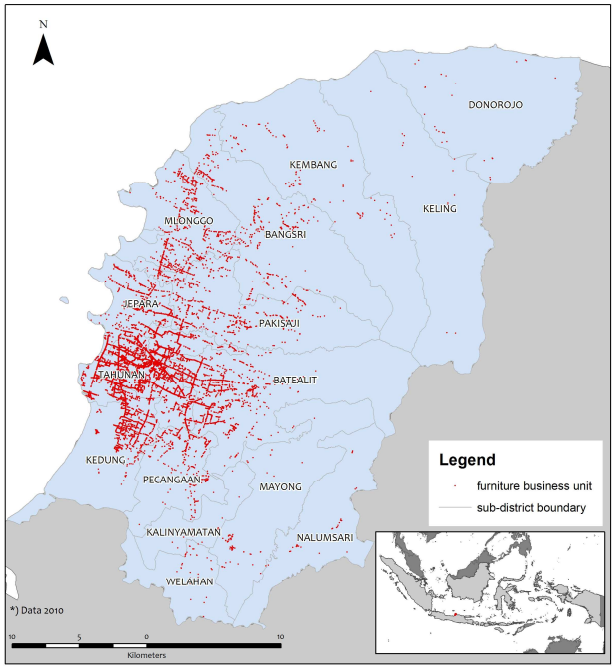

Figure 1. Spatial distribution of furniture enterprises in Jepara. Source: Jepara Survey (2010) updating Roda *et al.* (2007).

Target respondents in this study were SMEs using cellular phones or the Internet (see Figure 2). There is no universally accepted definition of ICT. We used a working definition that took into consideration how existing digital technology helps individuals, businesses and organisations access information. We chose cellular phones because they are in common use by small-scale producers in Jepara, but also wanted to look at SMEs' Internet access, both via computers and smart phones. Twenty respondents were interviewed for this preliminary study.

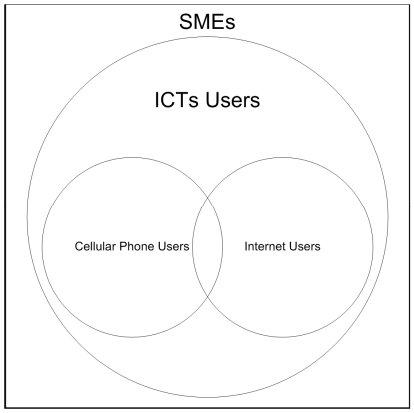

Figure 2. Target respondents selected for the study.

We used structured questionnaires for the interviews, to ask respondents about key qualitative and quantitative information (Table 1). Qualitative information was used to circumvent respondents' reluctance to answer questions on sensitive issues such as income or education. We used the information collected and applied hypothetical causality to assess parameters affecting SMEs' effectiveness and efficiency and equity in ICT adoption (Figure 3).

The term effectiveness in the context of ICT means the use of ICT devices to maximise the production of goods and services. Efficiency refers direct income per unit cost of using ICT. In this study we focus only on marketing and numbers of products sold as a direct result of using ICT. Equity refers to distribution of accessibility to ICT among SMEs.

Here, equity is determined by financial, knowledge and physical capital; while effectiveness and efficiency require another determinant: strategy; in this case marketing strategy. Thus, disparity on strategy might also affect equity through effectiveness and efficiency.

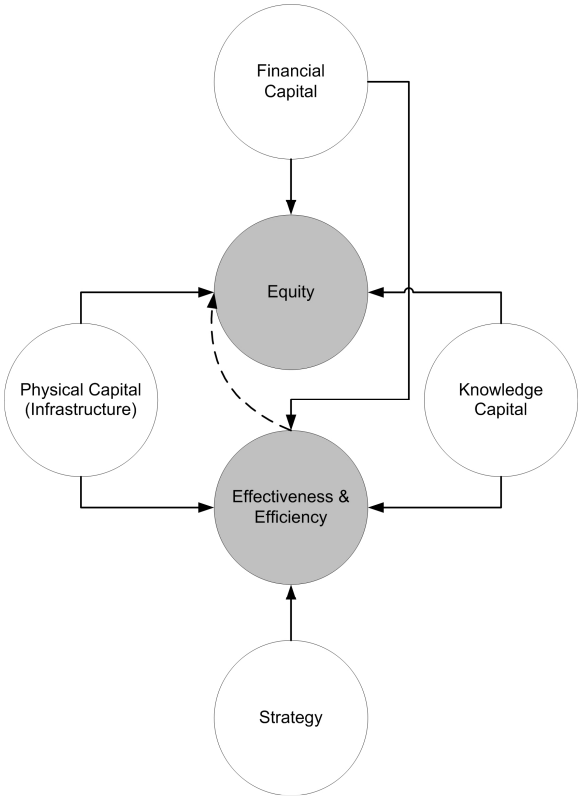

Figure 3. Causality of ICT effectiveness, efficiency, and equity, as hypothesised in this study. Equity is determined by financial, knowledge and physical capital; while effectiveness and efficiency require another driver; strategy. Thus, disparity on strategy might affect equity through effectiveness and efficiency.

TABLE 1. KEY INFORMATION ASKED IN THE INTERVIEWS

No.	Parameters	Key information	Information type
1.	Accessibility to/costs of ICT	Monthly expenditure for cellular and Internet-based communications	Quantitative
2.	Financial capital	Monthly income	Qualitative
3.	Knowledge capital	Education	Qualitative
4.	Knowledge capital	Capacity to use ICT	Qualitative
5.	Physical Capital (Infrastructure)	Performance of ICT' transmitting devices based on respondents' experiences	Qualitative
6.	Physical Capital (Infrastructure)	Number of ICT' receiving devices (cellular phones or computers) owned by respondents	Quantitative
7.	Marketing strategy	Number of products advertised through ICT: (i) cellular phones: phone calls and text messaging; (ii) Internet: e-mail, social networking, chatting, online news, blogs, collective/personal marketing portals, search engines and mailing lists.	Qualitative
8.	Impact of ICT use on marketing	Number of product selling as direct effect of advertisement through ICT: phone calls and text messaging, e-mail, social networking, chatting, online news, blogs, collective/personal marketing portals, search engines and mailing lists.	Qualitative

III. RESULTS

A. Equity

Small-scale producers' ICT usage ranges from basic technology, such as fixed line or cellular phones, to more advanced technology, including e-mail, e-commerce and information processing systems. Most small-scale producers make use of basic communications utilising cellular phones, which allow them to communicate with their suppliers and customers more economically and conveniently without requiring personal visits.

From the survey we found that most producers (60%) use cellular phones to communicate through phone calls and/or text messages. This is probably because cellular phones are affordable, easy to use and provide many benefits. A comparison between cellular phone and Internet use as a percentage of monthly expenditure is shown in the figure below.

The Lorenz curve is used to observe equity (or inequity) of wealth distribution. To create this graphical tool, the population was ranked according to its wealth (expenditure on ICT, ownership of ICT hardware) and then plotted as a percentage of the population owning each percentage of the wealth. For example, 30% of the wealth is owned by 50% of the population.

Figure 4 shows Lorenz curves to measure Jepara SMEs' ICT equity based on monthly expenditure for accessing cellular and internet-based technologies. Both curves deviate from the 1:1 line; an equal state of accessibility to ICT among the community. For cellular phones, 25% of producers share 9% of total expenditure, 50% of producers share 24% of total expenditure and 75% of producers share 52% of total expenditure.

Equity (inequity) in the distribution of ICT accessibility was measured using the Gini coefficient, derived from the Lorenz curve. It is calculated as the difference in area between the 1:1 line and the Lorenz curve, divided by the total area below the 1:1 line. Thus, when the Lorenz Curve equals the 1:1 line, the Gini coefficient equals 0; indicating perfect equity (Delta, 2003).

The Gini coefficient for cellular phone use was 0.36, implying relatively equal accessibility. For the Internet, 50% of producers could not afford any expenditure at all, and 75% shared only 25% of total expenditure. The Gini coefficient of 0.68 implies relatively unequal accessibility.

Monthly income and education are clear determinants of Jepara SMEs' accessibility to the Internet, but less so to cellular phones (see Figure 5). Based on financial and knowledge capital parameters, cellular phones are currently more affordable, more triable and, consequently, more accessible to SMEs than the Internet is.

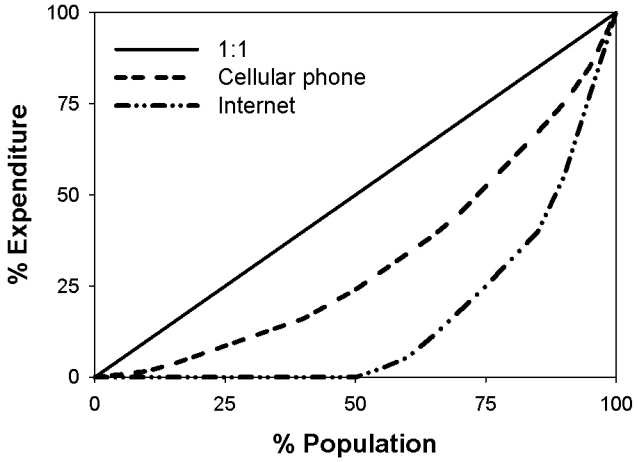

Figure 4. Jepara SMEs' ICT equity based on monthly expenditure for accessing cellular and internet-based technologies. Accessibility to cellular phones is relatively equal (Gini coefficient = 0.36); while accessibility to the Internet is relatively unequal (Gini coefficient = 0.68).

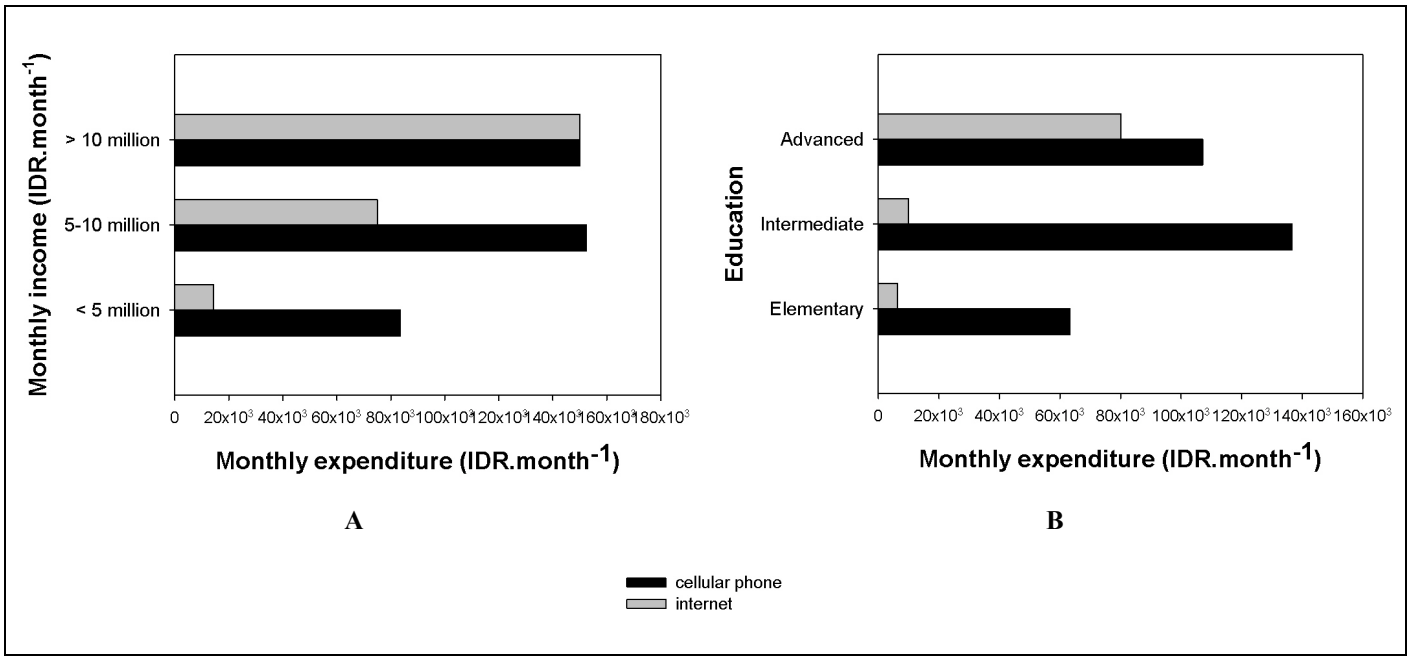

Figure 5. Monthly income (A) and education (B) are clear determinants of Jepara SMEs' monthly expenditure for Internet access, but less so for cellular phones

In the study, ICT accessibility is expressed as monthly expenditure on ICT (IDR per month-1). If we replot the correlation between income (financial capital) and expenditure (accessibility) shown in Figure 5 by combining expenditure for cellular phones and the Internet, we have a clearer illustration of how financial capital determines SMEs' accessibility to ICT (see Figure 6).

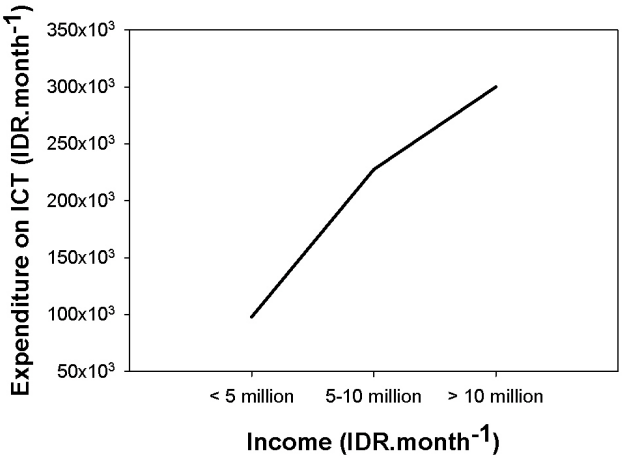

Figure 6. Correlation between income and expenditure on ICT.

Figure 7 confirms that Jepara SMEs' accessibility to ICT is also determined by their technical capacity to use such technologies. This is expressed as application complexity. Accessibility increases with ICT proficiency.

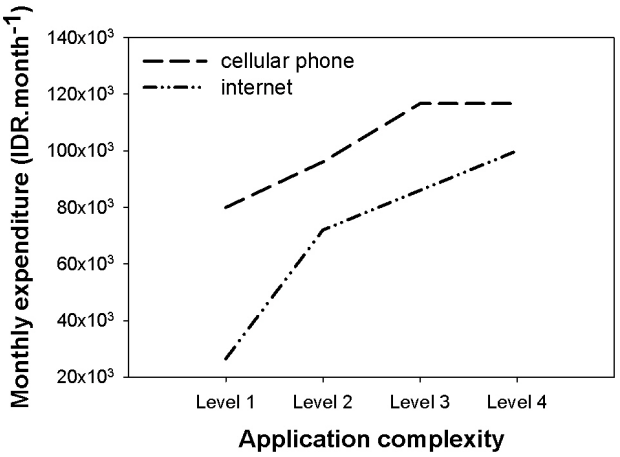

Figure 7. Jepara SMEs' monthly expenditure on ICT is also determined by their technical capacity to use such technologies. This is expressed as application complexity. Here, the complexity is qualitative, and increases with expenditure. We classified Internet users by four levels: Level 1 for basic users; Level 2 for capacity to use simple applications, such as web the capacity to develop web programming systems blogs; Level 3 for capacity with middle level applications; and Level 4 for for the capacity to develop web programming systems.

Figure 8 shows that knowledge levels increase with financial capital.

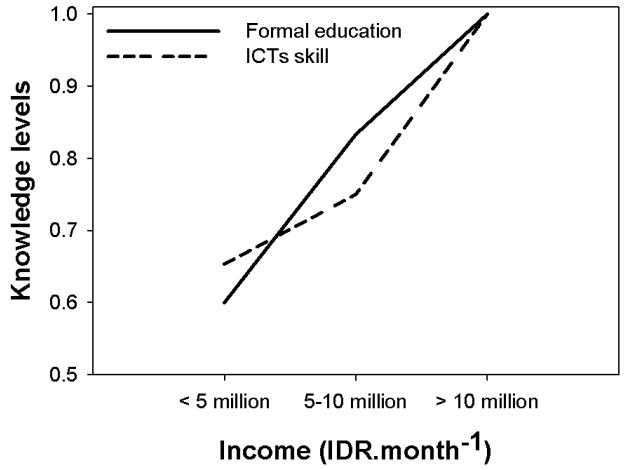

Figure 8. The correlation between income and knowledge levels. Here, knowledge levels are qualitative; rescaled from 0 (low) to 1 (high)

ICT providers' infrastructure is another factor determining Jepara SMEs' equity in accessing ICT (see Figure 9). SMEs' Internet connection speeds ranged from slow to fast, while most have relatively good cellular phone signals, due primarily to the infrastructure installed by providers; with BTS (Base Transceiver Station) towers found near almost all urban and rural respondents' homes or workplaces.

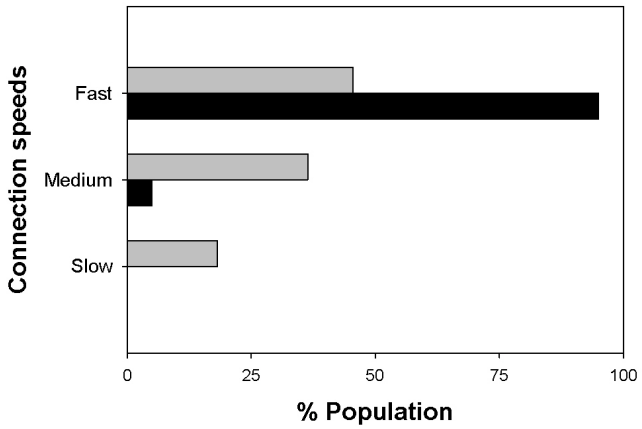

Figure 9. SMEs' Internet connection speeds range from slow to fast in Jepara, while most have relatively good cellular phone signals.

The Lorenz curve in Figure 10 shows Jepara SMEs' ICT hardware ownership equity. The pattern corresponds with the previous Lorenz curve showing unequal distribution of ICT accessibility (see Figure 4). Consequently, SMEs' ownership of ICT infrastructure (hardware) should be another contributing factor to their ICT accessibility. Here, the Gini coefficients for cellular phone and Internet use are 0.18 (relatively equal) and 0.63 (relatively unequal) respectively.

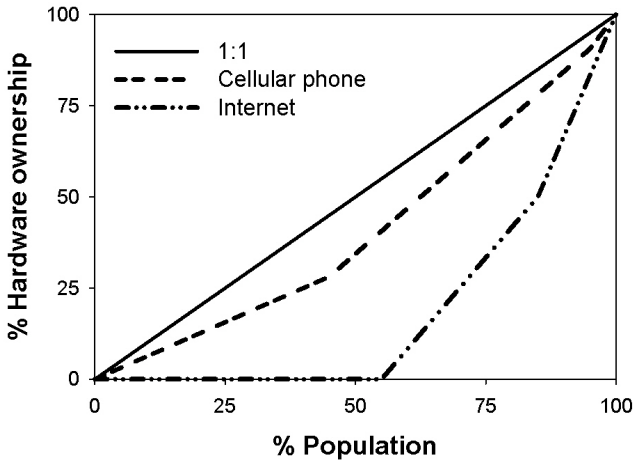

Figure 10. Lorenz curves showing equity of ICT hardware ownership by SMEs in Jepara.

The pie charts in Figure 11 show SME composition by monthly income and education. Income levels are relatively unequal, whereas levels of education are relatively uniform. Thus, the unequal accessibility to ICT, illustrated by the Lorenz curve in Figure 4, is determined more by income than education. However, when technology is more accessible (cheaper and easier to use) as is the case with cellular phones, small-scale producers' equity to access ICT may not be determined by their financial capital at all.

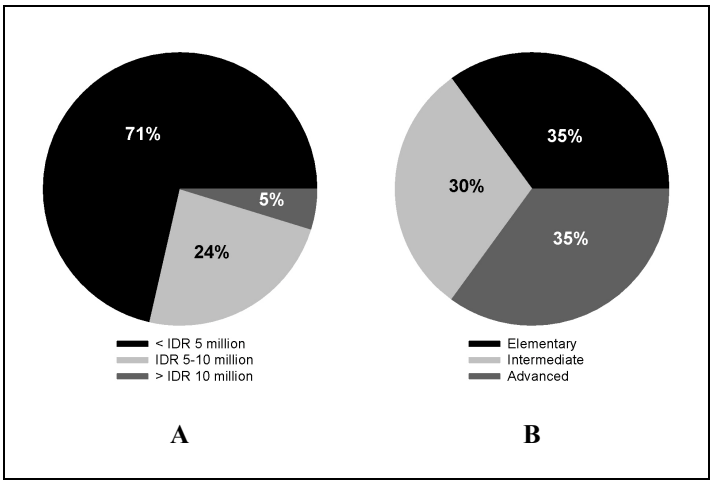

Figure 11. SME composition by monthly income (A) and education (B). Income levels are relatively unequal, whereas levels of education are relatively uniform.

B. Effectiveness

After acquiring basic communications capabilities (using cellular or fixed line phones), the next ICT upgrade is

usually a personal computer (PC) or laptop with rudimentary software. Even without Internet connectivity, small-scale producers can use PCs for basic word processing, accounting and other business practices, including using drawing software to design furniture products. With the Internet, small-scale producers can use more advanced communications capabilities such as e-mail, file sharing, website creation, blogging and e-commerce (marketing portals and business websites). This may be sufficient for most producers, particularly those with ICT capacity and a wider market range.

As mentioned above, some producers' access is limited by their low levels of income. Those who already utilise the Internet for their businesses commonly do so for marketing. Producers with higher level ICT skills can develop weblogs, use marketing portals, join social networking sites or even create their own websites to promote their products.

Figure 12 shows the effectiveness of using ICT for advertising products by media choice and media placement. Media choice is a strategic decision made by choosing a particular medium selectively, based on considerations of efficiency and capital limitations. With cellular phones, SMEs can advertise their products by calling or texting people listed in their phone books. Those with Internet access can advertise using e-mail, marketing portals, weblogs or even by making online advertisements.

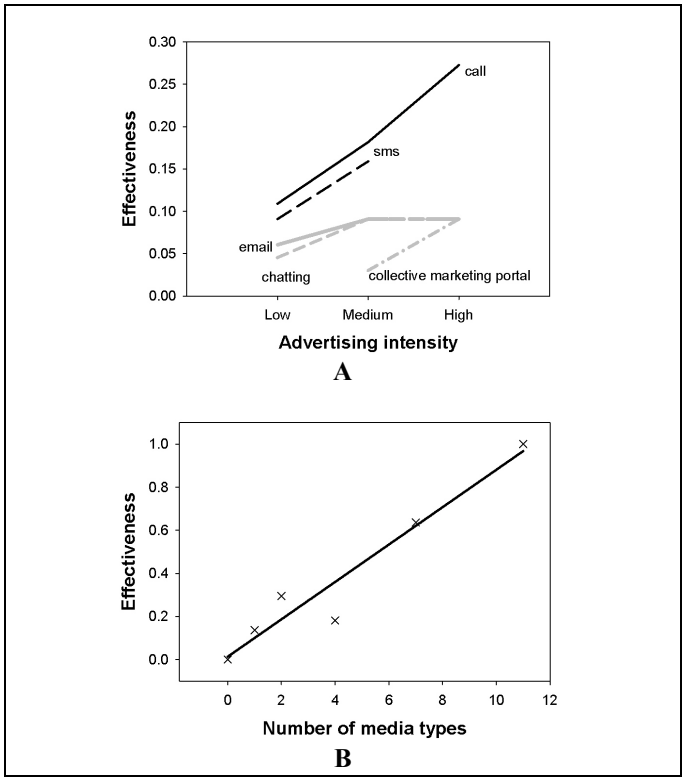

Figure 12. Effectiveness of using ICT for advertising products by media choice (A) and by media placement (B). Here, effectiveness is measured qualitatively using product sales intensity as a direct result of the advertisement, rescaled from 0 (none) to 1 (high).

Here, effectiveness was measured qualitatively using product sales intensity as a direct result of the advertisement. Using cellular phones is more effective than using the Internet. However, the effectiveness of using ICT for marketing is determined more by media placement than media choice. The graph suggests that effectiveness increases for both cellular phones and the Internet with the number of online media used for advertising. Therefore, a 'bombardment' strategy; advertising products through all available online media is the most effective approach.

It is obvious that SMEs with greater financial capital and better access to ICT would earn more from using ICT more effectively (Figure 13).

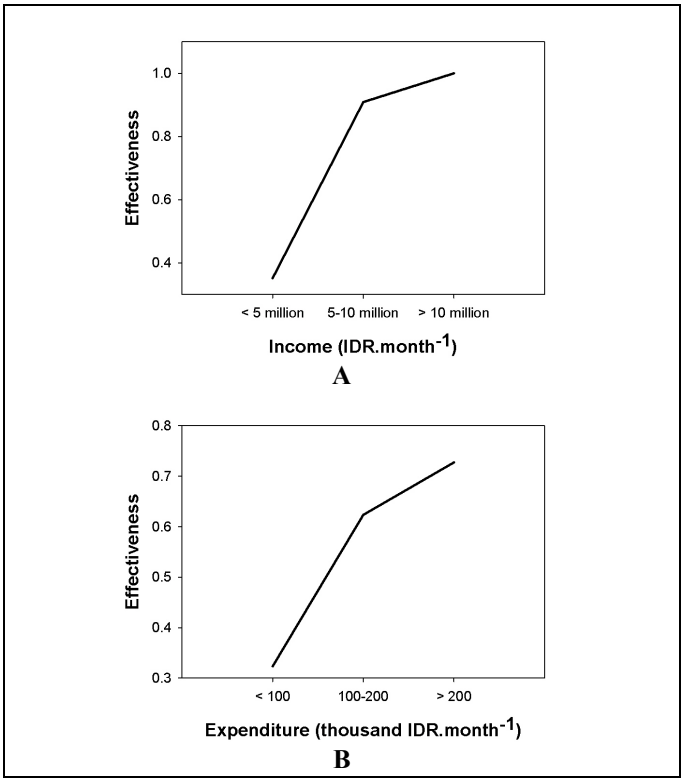

Figure 13. Effectiveness of using ICT for advertising products by income (A) and expenditure on ICT (B). Here, effectiveness is measured qualitatively using product sales intensity as a direct result of the advertisement, rescaled from 0 (none) to 1 (high).

C. Efficiency

Figure 14 shows the efficiency of using ICT for advertising products by media choice and media placement. Here, efficiency was measured qualitatively using product sales intensity as a direct result of the advertisement per unit cost expended for accessing ICT. In general, the efficiency of ICT use - for both cellular phones and the Internet - for both cellular phones and the Internet - for marketing is determined more by media choice than media placement. Therefore, with limited capital, media choice is a more efficient strategy than media placement.

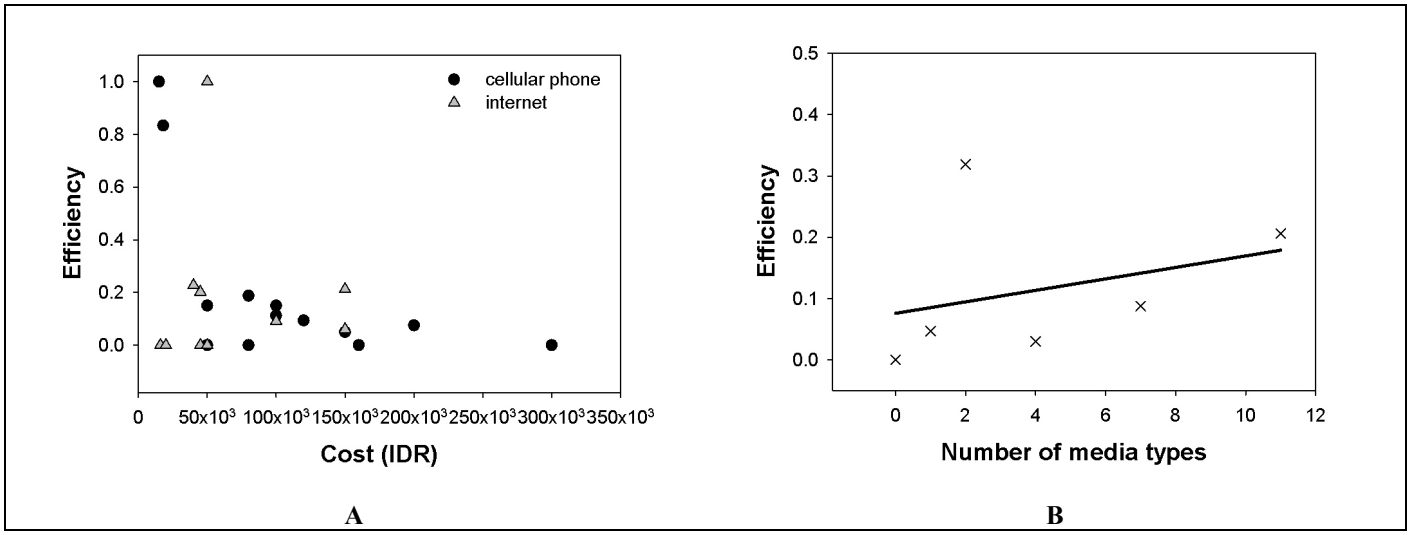

Figure 14. Efficiency of ICT use for advertising by media choice (A) and media placement (B). Here, effectiveness is measured qualitatively using product sales intensity as a direct result of the advertisement per unit cost expended for accessing ICT, rescaled from 0 (none) to 1 (high).

With regards to SMEs' financial capital and accessibility to ICT, it is obvious that those with less financial capital and poorer access to ICT should choose more efficient ICT use (Figure 15).

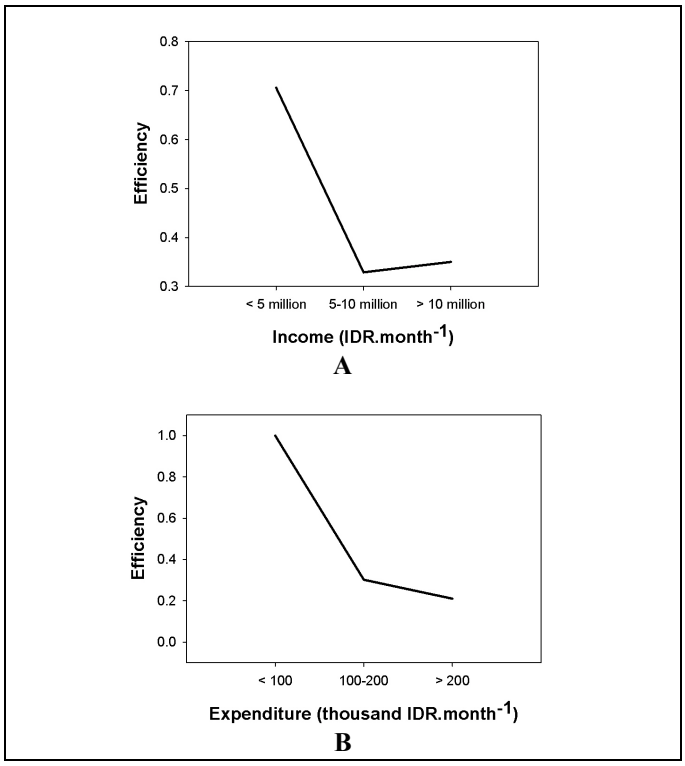

Figure 15. Efficiency of using ICT for advertising products by income (A) and by expenditure on ICT (B). Here, effectiveness is measured qualitatively using product sales intensity as a direct result of the advertisement per unit cost expended for accessing ICT, rescaled from 0 (none) to 1 (high).

IV. DISCUSSIONS

A. What causes the digital divide?

The digital divide is the gap between people with effective access to digital and information technology, and those with very limited or no access at all. The real issue with the digital divide is not so much access to digital technology as the benefits derived from that access as well as its aims.

Access to digital technology by small-scale furniture producers greatly enhances the effectiveness and affordability of their efforts to increase wood supply, improve product quality and design, generate jobs, and address any other issues pertinent to their enterprises.

Cellular phone technology is more accessible to many users. It costs less than the Internet, requires fewer skills and is commonly used in everyday life; however, it does have its limitations. Using the Internet, people can connect with others all over the world without the need to know them personally. With cellular phone, however, people tend to contact those already listed in their phone books.

In this study, the digital divide is articulated through the equity indicator for SMEs' accessibility to ICT, as expressed by their expenditure on ICT (IDR per month^{-1}). We used this parameter as it measures the actual accessibility of SMEs to ICT. From Figure 6, we found that accessibility is determined by financial capital, as expressed by their income (IDR month^{-1}). Richer SMEs have better access to ICT, which apparently implies more effective ICT utilisation (Figure 13B), but much less efficient ICT use (Figure 15B). However, Figure 13A and 15A suggest that SMEs' ICT choice is limited by their financial capital. Richer SMEs use

ICT more effectively regardless of their efficiency. Thus, SMEs' choice to base ICT on effectiveness or efficiency should be considered part of their adaptive strategy. Yet, in order to explore causality of the digital divide, we used effectiveness to measure the quality of ICT accessibility. Moreover, effectiveness indicates 'payoffs' secured from 'investment', while efficiency indicates 'energy/costs' expended for 'investment'. Again, effectiveness is more relevant in this regard.

Figure 8 explains that financial capital is also closely related to knowledge capital, so richer SMEs tend to have better knowledge. Furthermore, Figure 5B and Figure 7 verify that better knowledge means better accessibility to ICT. We synthesized these findings into a general causal loop diagram, showing that with better financial capital, SMEs will have better knowledge and physical capital, and, consequently, better accessibility to ICT and better effectiveness that ultimately increases their financial capital (Figure 16). Hence, we can conclude there is a positive feedback loop of causal interactions between financial capital, knowledge capital, physical capital, accessibility to ICT and effectiveness. This implies that by using ICT, rich SMEs will become richer and poor SMEs will become poorer; thus worsening the digital divide.

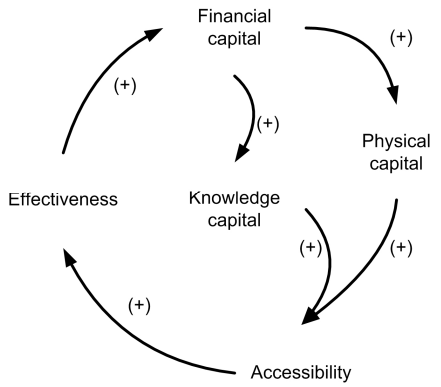

Figure 16. A positive feedback loop of causal interactions between financial capital, knowledge capital, physical capital, accessibility to ICT and effectiveness.

B. How can we mitigate the digital divide?

The digital divide at the lower end and middle of the income scale cannot be mitigated by providing technological means. It will not be effective if recipients cannot operate hardware properly and are unsure how to benefit from its use. As stated at digitaldivide.org; 'Closing the Digital Divide is fundamentally about empowerment, that is, it is about using new technologies to empower the lower middle classes just as they now empower the upper level (rich)'. But, neither ICT companies nor government explain in any depth how empowerment works, and fail to differentiate between technology that empowers and technology that does the opposite.

When ICT companies and government talk about providing 'solutions' to users, they are talking about fulfilling users' aspirations and needs, which is empowering to them. Thus, to mitigate the digital divide it is essential to empower the poor by closely studying their circumstances and finding ways to shift the contexts that exacerbate their poverty. On the other hand, it is important to question whether ICT will improve their livelihoods, and whether higher incomes and improved access to ICT will be a perpetual cycle.

According to the simple causality diagram in Figure 16, ICT use can intensify inequality of 'wealth'. The diagram also implies that ICT can enhance equity of 'wealth'. Hence, when we take financial capital as a starting point, its initial state does matter in creating or mitigating a digital divide. In this case, economy-related policies should take priority (Table 2). If we start from knowledge capital, then education-related policies should take priority, and if we start from physical capital, ICT-related policies should take priority. Another scenario is by strengthening community collaboration to generate capital in all pools.

TABLE 2. SCENARIOS FOR MITIGATING THE DIGITAL DIVIDE

Pools / Actors	Financial capital	Knowledge capital	Physical capital
Government	Improve economy-related policies	Improve education-related policies	Improve ICT-related policies
ICT company providers		Corporate social responsibility programmes relating to ICT skills empowerment	Facilitate and give hardware to SMEs
Communities	Strengthen collaboration (rural-rural, urban-rural, western Indonesia-eastern Indonesia, north-south, south-south, etc.)		

As an example scenario, furniture producing SMEs that have already joined a producers' association could submit a proposal to an ICT provider mentioning their aspirations and requesting an empowerment programme. Such a programme could involve providing hardware and the skills and knowledge necessary to use ICT to improve livelihoods. A programme such as this would be more effective if it had the support of the government, which could explore the use of cell phones, already widely used by small-scale businesses; improve policies to go beyond text messaging and make use of the multimedia capacity of the Web; build applications using icons on handheld devices; support Internet access on low bandwidth devices; and support web content in Indonesian and local languages.

Government support can certainly increase ICT access. An example of this in Jepara is a statue producing village in the district being facilitated by the provincial government, which provided a Wi-Fi transmitter. The real impacts of this

facilitation are the community establishing an Internet use institution, and villagers having better Internet access than other villages in the district.

Jepara has a district-level association of small-scale furniture producers across the region. The association has developed a marketing portal to promote its members' products. In order to bridge the digital divide between association members, the portal lists cellular phone numbers for producers already promoting their products through the portal but with no Internet access. Those with access, meanwhile, can include their e-mail addresses or even simple weblogs to promote their products. Here, cellular phone and Internet are combined to promote furniture products more efficiently and effectively.

The association regulates the portal's use for marketing, and has assigned persons responsible for online and offline customer service. It has village-level local administrators, and a top-level administrator for product content checks and quality control before delivery to buyers.

A similar thing could be adopted in other industries, such as rattan, which involves a chain of activities in generating its products. Along with providing a direct source of employment for rural communities, rattan plays an important role in the ecosystem, as well as the national economy, not just in Indonesia, but also abroad. The Philippines is one rattan producing country, and according to Antolin (1994) its rattan industry has problems with raw materials and fierce competition problems also facing the furniture industry in Jepara.

Using ICT to face the problem of fierce competition could possibly sustain the rattan industry and increase sales volume and value. A rattan organisation could convene to ensure proper protection and management of rattan resources, and help its members promote their products using ICT. The government could help through strict enforcement of regulations aimed at ensuring sustainability of, and access to, rattan resources, and providing ICT access to small-scale producers, which are the backbone of the industry.

V. CONCLUSIONS

- This study found a positive feedback loop of causal interactions between financial capital, knowledge capital, physical capital, accessibility to ICT and its effectiveness. This implies that ICT use can make rich SMEs richer and poor SMEs poorer. On a larger scale, ICT use can make wealthy countries wealthier and poor countries more impoverished; and consequently worsen the digital divide on both scales.

- Based on the simple causality diagram, ICT use can intensify inequality of 'wealth'. The diagram also implies that ICT can enhance equity of 'wealth'. Hence, when we take financial capital as a starting point, its initial state does matter in creating or mitigating a digital divide. If this is the case, economy-related policies should take priority. If we start from knowledge capital, then education-related policies should take priority, and if we start from physical capital, ICT-related policies should take priority. Another scenario is by strengthening community collaboration to generate capital. All of these scenarios are generic and should be applicable on any scale, from local to global.

- This paper presents preliminary findings, and aims at mapping the general ICT situation among SMEs in Jepara. Further studies should at least explore: (i) capital disparity; (ii) strategies for coping with capital disparity (the digital divide), including altruistic/egocentric behaviour; (iii) consumer behaviour in relation to ICT use; and (iv) quantitative cost-benefit analyses of SMEs' ICT use at each stage of the furniture production process.

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