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Impact of Digital Technologies on Social Productivity growth of Microfinance Institutions in Indonesia

Joanna Vogeley
Macquarie Graduate School of Management
MGSM, 99 Talavera Road, North Ryde
NSW 2113, Australia
Joanna.vogeley@students.mq.edu.au

Delaram Najmaei Lonbani
Macquarie Graduate School of Management
MGSM, 99 Talavera Road, North Ryde
NSW 2113, Australia
delaram.najmaei-lonbani@students.mq.edu.au

***Abstract*—. Over the past decade, many microfinance institutions (MFIs) have implemented various innovative financial solutions, including mobile-phone financial services, aiming to improve their social and financial productivity. This impact is therefore examined using qualitative and quantitative methods., we have applied in stage one DEA-based Malmquist Index to measure the growth in social efficiency of Indonesia MFIs and in stage two, critical discourse analysis is conducted on digital technologies, in particular mobile money applications in Indonesia which links to the contemporary digital landscape. The first part of the analysis illustrates the change in efficiency and digital technology as well total outreach grwth. Furthermore, the findings determine whether, how, and why (not) digital technologies in particular, mobile money applications contribute to the growth in social efficiency across selected microfinance institutions in Indonesia. The findings detail the way in which a range of financial services is (not) coherent across daily undertakings across underprivileged communities, and demonstrates how scholars can expand the field, where social efficiency can be achieved.**

Keywords*— *Digital, Digital Finance, Impact, Indonesia, Microfinance, Malmquist Index, Productivity Growth..

I. INTRODUCTION

Digital Technologies, in particular, mobile money applications, have a significant impact on social productivity of microfinance and financial inclusion for the underprivileged communities in Indonesia (Dalberg, 2017; NextBillion, 2017; Suri, 2017). The World Bank (2017) described financial inclusion as a responsible and sustainable process where agents (individuals and businesses) can access reasonably priced financial products and services to undertake transactions, make payments, access credit and insurance. As one of the earliest countries in the implementation of microfinance institutions (MFIs), by Bank Rakyat Indonesia, Indonesian MFIs are worth the examination. In this study, we only focused on the efficiency of MFIs from breadth of outreach. Mobile devices across Southeast Asia have become ubiquitous and act as an dynamic extension of everyday life (Dalberg, 2017; Lauria, 2017) but the impact of mobile money across underserved communities on social productivity of microfinance institutions' outreach needs yet to catch up with the digital era (NextBillion, 2017), and indicates the necessity of research on the correlation of digital technology growth and the outreach growth of MFIs. This relationship has been examined by prior scholars using a qualitative approach by Harraf (2008) and a recent report by *The Financial Inclusion Insights* (FII, 2017) collected qualitative data from Indonesia on mobile money across "unbanked" groups. Quantitative studies also have been undertaken by Anangwe (2014); Diniz, Jayo, Pozzebon, Lavoie, and dos Santos Foguel (2014). Nonetheless, this study believes that the application of a mixed method approach can result in a more holistic and practical solution. To this end, this study employs a quantitative analysis by measuring the growth in social efficiency of two medium and four large MFIs in Indonesia and extracting the impact of digital technological advancements that contribute to change. In the second stage of the analysis, we implemented a qualitative analysis on digital technologies, in particular the use of mobile money applications among underprivileged communities in Indonesia, and asses if a range of financial services is (not) being coherent across daily undertakings. the digital landscape in indonesia

Indonesia is an archipelago nation of more than 18,000 islands (from 17, 508 in 1996 to 18,000 in 2003, from which 6000 are inhabited) (Blakemore, 2017). The geography of the country alone demands investment in social and commercial networking infrastructure (KPMG, 2015). On a global scale, it has been estimated that Indonesia will become the fourth largest economy by 2050 (Oktaviani, Rooney, McKenna, & Zacher, 2016). The country has also the fourth-largest population and the country classifies 37th on the World Economic Forum's (WEF) 2015-16 Global Competitiveness Index (GCI) (GCR, 2016). Locally, Indonesia accomplishments have overtaken those of the West. The gap and distinction has not been represented yet across an official scale (Baumann & Setogawa, 2015). While the country has much potential, Indonesia is still in its early stages of awareness when it comes to the implementation of digital technologies (mobile money applications) across underserved communities (NextBillion, 2017). In Indonesia, over 100 million people use wood for cooking and over 90 million have no access to electricity (Bolton, 2014).

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Digital technologies act as a crucial enabler to overcome geographic limitations and assist in the development of a nation (Vong & Song, 2015). The digital divide, has become framed as a central impediment to development, where new digital financial solutions/combinations can act as a response to financial, economic and social challenges (Schumpeter, 1934; Suri, 2017). In line with Schumpeter (1934) we agree that new digital combinations (mobile money which offers a range of financial services) disrupt the traditional flow (traditional microfinance), also known as the creative destruction (Windruma & Garc´ıa-Goni, 2008). However, we also acknowledge that for many underprivileged communities across Southeast Asia, traditional microfinance is the only source of income (Dalberg, 2017).

While there are claims about the significance of digital technologies for underserved communities, the empirical evidence is limited. Moreover, we have little evidence how digital technologies impact the social productivity of microfinance.

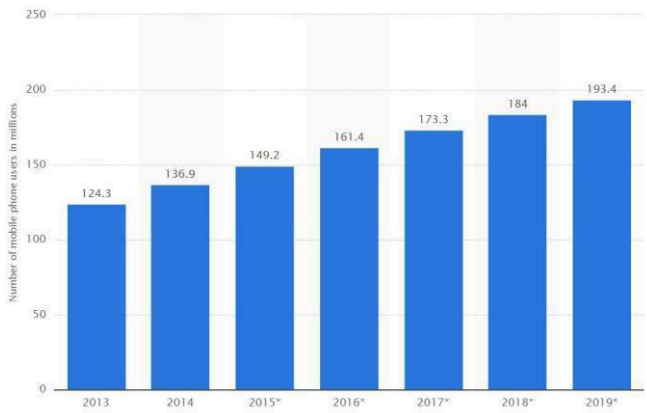
II. Indonesia's Microfinance Sector and New Emerging Digital Technologies

Global Business Indonesia (2013) shed light on the large microfinance sector in Indonesia which reached over 50 million people through more than 60,000 microfinance institutions in 2013. In addition, there are 260 million mobile subscribers and 143 million act as unique mobile subscribers who empower underprivileged citizens to have access to finance (op. cit.). Digital technologies are powerful and significant enablers, revolutionising the traditional microfinance sector. As McLuhan once stated: "We shape our tools and our tools shape us" (1994, p. 31). A supportive environment contributes to the economic growth and acts as a catalyst to transformation (Dalberg, 2017). However, many micro players like Bank Rakyat Indonesia (BRI) ask their customers to demonstrate income proof and make it impossible for underprivileged communities to access flexible finance (Global Business Indonesia, 2013). In response to these strict regulations organisations like Kopernik who connect simple technologies with communities (Lim, Chia, & Aravind, 2016) developed various initiatives in remote areas of Indonesia to boost employment (Bolton, 2014), which in turn provides financial gains (Kopernik, 2017). Indonesia is also famous for its loan sharks and illegal motorcycle lenders and many microfinance instructions are based in urban cities like Java or Sumatra, disconnected from remote areas (Global Business Indonesia, 2013). As a response to those challenging economics, the arrival of mobile banking is gaining momentum across many Southeast Asian underserved communities and (or) the "unbanked" people based across remote areas (Global Business Indonesia, 2013; Murphy, 2013; NextBillion, 2017). Unfortunately, vast majority of the "unbanked" population are not actively completing transitions due to connectivity issues (Azali, 2016; Global Business Indonesia, 2013). Beyond mobile money being available it is important to pay attention how these innovative solutions are communicated to underprivileged communities and how the right network can scale and contribute to microfinance growth (Dalberg, 2017).

III. Mobile Money in Indonesia

Past literature on mobile money for the "unbanked" confirmed that while mobile subscriptions are growing, Indonesia is still heavily depending on traditional cash payment (Azali, 2016) as there are trust issues (Idris & Hijrah Hati, 2013), lack of educational on services and products available and poor logistics as well as slow Internet connection (Azali, 2016).

Figure 4.1 illustrates the total number of mobile phones users in Indonesia from 2014-2015 (Statista, 2017).



Source adapted from the Statistical Portal (Statista, 2017).

Digital technologies can not only create financial inclusion but also contribute to economic growth in Indonesia. A report by McKinsey predicted that by going digital the country can generate USD 150 billion in annual economic impact by 2025 (Das, Gryseels, Sudhir, & Tan, 2016). Further, Indonesia has not adapted latest modern digital technologies even though the country is digitally the most active (Das et al., 2016; NextBillion, 2017). McKinsey also stated that Indonesia has a long way to go and does not capture the countries digital potential and needs to increase the labour productivity (Das et al., 2016).

IV. Methods

This study's analysis is grounded on two separate methods which together build the framework. In stage one, we have used the quantitative method for the analysis of six MFIs productivity growth. In stage two, we have used a qualitative method, to explain the result gained in the first stage from mobile banking prospective *Stage 1*

For quantitative analysis of MFIs productivity growth, we applied DEA-based Malmquist Productivity index since, from methodological point of view, multivariate analysis result in more reliable solution (Gutierrez-Nieto, Serrano-Cinca, & Molinero, 2007). In this study, we considered the social performance as the success of MFI in transforming the inputs, assets and employees, to social outreach, gross loan portfolio and number of active borrowers. As the sample is small, to minimise the sample bias, we employed bootstrap Malmquist proposed by Simar and Wilson (1999).

Productivity dynamics of economic units have been measured by three predominant methods of Tornquist, Fisher and the Malmquist Index (MI) (Bassem, 2014). MI, proposed by Malmquist (1953), is superior due to lack of restriction on profit-maximisation, or cost minimisation assumption and input-output price (Grifell-Tatje & Lovell, 1996). Moreover, Analysing the productivity dynamics by Malmquist will uniquely enable the researcher to delve into the source of productivity change in terms of efficiency change or technological advance (Grifell-Tatje & Lovell, 1996).

DEA-based Malmquist is first developed by Färe, Grosskopf, Lindgren, and Roos (1992), and is further extended to Malmquist model that measures efficiency of each period by Data Envelopment Analysis (DEA). DEA-based models are in particular appropriate for non-governmental decision making entities whose main objective is not profit (Charnes, Cooper, & Rhodes, 1978). Moreover, as a non-parametric method, DEA is suitable in handling multiple inputs and outputs, without being restricted in specifying production or cost function since the model is based on frontier, and not central tendencies (Grifell-Tatje & Lovell, 1996).

Following Färe, Grosskopf, Lindgren, and Roos (1994), the Malmquist Productivity Index is based on input/ output distance function defined respectively by radial scaling of input and output.

If $X^t \in R^n \; and \; Y^t \in R^m$ are input and output vector,

Then, the production technology of time T is:

$$S^t = \{(X^t, Y^t) | \; X^t can \; produce \; Y^t\}$$

And, the distance function of time T is defined as:

$$D_0^t(X^t, Y^t) = \inf\{\theta | (X^t, Y^t/\theta) \in S^t\}$$

Similarly, the output distance function of time t+1 is:

$$D_0^{t+1}(X^{t+1}, Y^{t+1}) = \inf\{\theta | (X^{t+1}, Y^{t+1}/\theta) \in S^{t+1}\}$$

Now, we define a new distance function as:

$$D_0^t(X^{t+1}, Y^{t+1}) = \inf\{\theta | (X^{t+1}, Y^{t+1}/\theta) \in S^t\}$$

Which measures the maximal proportional change in output required to make (X^{t+1}, Y^{t+1}) feasible in relation to technology at time T. if we define a similar distance function to capture maximal proportional change in output considering the technology at time T+1.

Therefore, the Malmquist index is:

$$M^t{}_0(X^{t+1}, Y^{t+1}, X^t, Y^t) = \underbrace{\left[\frac{d_0^{t+1}(X^{t+1}, Y^{t+1})}{d_0^{t+1}(X^t, Y^t)}\right]}_{A} \times \underbrace{\left[\frac{d_0^t(X^{t+1}, Y^{t+1})}{d_0^{t+1}(X^{t+1}, Y^{t+1})} \times \frac{d_0^t(X^t, Y^t)}{d_0^{t+1}(X^t, Y^t)}\right]^{1/2}}_{B}$$

This index is a decomposition of two source of change in productivity; "A" that represents the change in technical efficiency between time t and t + 1. "A" moves towards the production frontier when the ratio is greater than one, while if the MFIs moves away from the productionfrontier the ratio will be less than 1. In the case of stagnation, "A" would be 1.

The term B that indicates the change in digital technology (technological progress) between the two periods t and t + 1. Similar indication of values of less, greater and equal to 1 is the case for "B".

To compute the index, in addition to its decompositions, we apply the professional version of MAXDEA software MaxDEA-Pro 6.18 developed by Gang and Hua (2009).

Stage 2

In order to obtain a full understating of digital technologies, particularly mobile money applications across underprivileged communities in Indonesia, we have applied critical discourse analysis (CDA) in stage two of this study. The qualitative analysis examined content across organisational reports and literature. CDA has been applied to ensure validity (Denzin, 1978; Davis and Golicic, 2012; Hall and Howard, 2008). In addressing the *"why"* and *"how"* across marginalised groups, we have made new judgments which shed more light on mobile money applications across the "unbanked". The aim of the examination is to understand various discourses across MFIs, media and scholars. The analysis has been inspired by Fairclough's (2003) who believes that reports created by various actors inspire and contribute to transformations across social contexts. In support to stage one of this method, stage two reveals if digital technologies have an impact across remote areas on the "unbanked".A software program NVivo was used to conduct the analysis and we have examined 40 organisational report, media articles and literature.

V. DATA

Data for MFIs has been collected from the Microfinance Information Exchange (MIX), which is a not-for-profit organisation aiming to provide data on financial services to marginalised community across the globe. The selection of inputs and outputs is based on prior studies. As applied by Gutierrez-Nieto et al. (2007); Gutierrez-Nieto, Serrano-Cinca, and Molinero (2009), we selected total assets and number of employees as the input. Breadth of outreach is also measured by number of active borrowers, as employed by Wijesiri and Meoli (2015)and gross loan portfolio, as applied by Widiarto and Emrouznejad (2015). Table 1 represents the descriptive statistics of selected inputs and outputs in two years of the study. This is, hence, concluded that on average the size of firms increases by considering total number of employees as the size. 87 employees 2014 and 90 personnel in 2015 to 2184 and 2808 employees in 2014 and 2015

TABLE 6.1 DESCRIPTION STATISTIC OF INPUTS/OUTPUTS

2014					2015			
Mean	780.3333	19.96667	16.035	144.1367	1054.833	27.26667	21.605	180.6
Min	87	3.05	2.03	3.98	90	4.69	3.32	4.51
Max	2184	68.06	58.13	492.99	2808	93.92	77.05	581.58
St Dev	728.378	22.576	19.448	168.983	965.979	31.154	25.711	199.421

VI. RESULTS

The results are gained from linear programming applied to measure Malmquist Index as discussed before. Malmquist Index (MI) represents the rate of growth in breadth of outreach and is further decomposed into efficiency change (EFFIC) and technological change (TEC). Efficiency change refers to the diffusion of technology (Alam, 2001) and technological change implies movements in the best practice production function (Nishimizu & Page, 1982). Table 2 illustrates the change in efficiency and technology as well as the Malmquist Index that implies the social productivity change. To save space, we only write the results of bootstrap procedure that are significantly different from 1 at 0.05 level. Numbers greater than 1 indicate progress, while the numbers less than 1 mean regress. Therefore, the result clearly shows improvement in technology for all MFIs that leads to improvement of productivity of outreach breadth for 4 microfinance. However, the decline in efficiency prevents the technological advance to improve the outreach breadth for two MFIs, Bina Artha and PT BPR Dana Mandiri Bogor.

TABLE 7.1 SOCIAL PRODUCTIVITY CHANGE FOR EACH MFI BETWEEN 2014-2015

Institutions	EFFIC	TEC	MI
CU Sawiran	1.000	1.105	1.105
Bina Artha	0.889	1.005	0.894
KOMIDA	0.896	1.143	1.024
MBK Ventura	0.934	1.168	1.091
PT BPR Dana Mandiri Bogor	0.970	1.002	0.973
PT Dana Mandiri Sejahtera	0.989	1.013	1.001
Average	0.946	1.073	1.014

VII. CONCLUSION

Through a digitised ecosystem and mobile money, the customer is the one who decides which financial service to selected rather than the other way around (NextBillion, 2017). Financial inclusion can only be created through a digital ecosystem and a strong agent network across the globe can strengthen digital technological developments across the world. It has been confirmed that if microfinance institutions don't develop a strategy and execute it through the adoption of digitisation, there is a high chance, that microfinance institutions will become redundant and surely but slowly disappear (NextBillion, 2017). We agree with past findings and confirm that underprivileged communities require a range of services, just the way every other citizens requires. The "unbanked" need services that offer savings, insurance, loans, credit cards that will allow them to manage household finances (NextBillion, 2017).

VIII. FUTURE RESEARCH

Digital financial services are not being integrated into the daily life in underserved communities across remote areas in Indonesia, more research is needed into how digital technologies can benefit from a deeper contexts in which financial, social and economic transformation occurs. Based on our analysis of CDA, and literature review, this study suggests future researchers need to focus on digital technologies development across Indonesia in the form of mobile money applications and the importance of a strong digital network, rather than governmental and instructional regulations. There is a large gap and a "bleed" between the government and beneficiaries who are transacting with the "unbanked" (NextBillion, 2017). A lot of money is lost in transit and a fully digitised ecosystem could prevent this fissure. More research is needed on how to create a digital footprint across the 261 million (World Population Review, 2017) Indonesian citizens.

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