
Technological change and innovations in microfinance institutions: What matters?

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Introduction

Since the establishment of microfinance in 1976, the landscape of microfinance has greatly changed in most of the countries driven by rapid technological improvement and external supports. To further ensure that Micro Finance Institutions (MFIs) can provide customized products and services to the poor with affordable prices, it is significantly important to observe technological progress. By attaining technological progress, MFIs is likely to attain cost efficiency, expanding the frontier of outreach to meet its dual objectives (Babu, 2016; Mia & Soltane, 2016). In this regard, technological change (TC) plays an important role in attaining resource efficiency of MFIs to promote sustainability. Hence, it is of significant interest not only to academicians but also to policy makers and management to identify the underlying determinants which may influence TC of MFIs. TC generally means the ability of a firm or an institution to optimally combine the inputs and outputs generated from better technology and capital equipment used in the production process (Chandran & Pandiyan, 2008).

In the recent development in microfinance research agenda, scholars are paying much interest in productivity and efficiency measurement of MFIs. Several studies have been conducted to reflect the significance of productivity of microfinance institutions in this area that evaluated either a single country or regional microfinance market (Babu & Kulshreshtha, 2014; Bassem, 2014; Gebremichael & Rani, 2012; Mia & Soltane, 2016; Mia & Chandran, 2016; Wijesiri & Meoli, 2015).

The productivity analysis of MFIs through Data Envelopment Analysis (DEA) predominantly concentrates in measuring Total Factor Productivity (TFP), which is then decomposed into Technical Efficiency (TEC) and TC. Some of the researchers are attributing higher productivity in the microfinance sector due to the changes in TEC. For instance, the most recent research work endeavored by Mia and Soltane (2016) on productivity measurement in South Asian MFIs deploying Malmquist Productivity Index (MPI) with a panel data covering 2007 to 2012 found annual average productivity progress by 2.1 percent due to change in TEC. In 2014, Bassem (2014) also conducted similar studies on MENA countries and concluded that TFP observed a progress of 4.9 percent annually, which is basically attributed to the changes in TEC. Subsequently, Mia and Chandran (2015) study on MFIs in Bangladesh also observed that the improved in productivity is due to better management practice and TEC. They have further highlighted that product innovations, such as, comprehensive saving products, innovative loans and usage of technology based services in the MFIs may enhance better productivity growth.

Additionally, Grabremichael and Rani (2012) found that out of 19 MFIs, 16 MFIs productivity have been improved due to the changes in TC. These findings highlighted that the progress in productivity may be enhanced by the overall innovations and development of various microfinance products in the Ethiopian microfinance market. Apart from that, Wijesiri and Meoli (2015) found very interesting results in the productivity of Kenyan microfinance industry. They attributed TC is the most important factors behind a higher productivity growth of around 7 percent for Kenyan microfinance market. Therefore, it can be inferred from the above study that technological change based productivity growth is relatively higher than managerial efficiency driven productivity growth, which highlights the importance of innovations and developments in microfinance operation.

Since microfinance is a service industry, providing banking financial supports to the poor, better technology and equipment is a context specific term which needs further clarification. Among others, Mia and Chandran (2016) defined that usage of information and communication technology, such as, computer, internet, mobile banking and ATM in operation of MFIs could be referred as better technology that are extensively used in the modern conventional banking system. Similarly, better equipment means the practice of latest products, methods of operation and techniques in providing microfinance services to the target clients with the minimal cost. Thus, this study aims to investigate what are the factors leading to technological development and innovations of MFIs.

Methodology

While there is no direct way to capture the technological development and innovations of MFIs in general, however, it is possible to measure TC by adopting Data Envelopment Analysis (DEA). By doing so, first, TFP change is estimated based on MPI and then TFP can be decomposed into technological change and technical efficiency change. Thus, this study follows a two-step analysis. First, a TFP is estimated for each of the MFIs and then decomposed into technological change and technical efficiency change. Then regress TC with a set of other explanatory variables. These explanatory variables can be varying from institutional characteristics, financial as well as macroeconomic factors that are likely to enhance technological progress in MFIs. Thus, the initial econometric model of the determinants of TC is as follows,

$$TC_{it} = \alpha_0 + \beta_1 LNAGE_{it} + \beta_2 (LNAGE)_{2it} + \beta_3 ROA_{it} + \beta_4 \ln Y_{it} + \beta_5 LOC_{it} + \gamma_1 INF_{it} + \gamma_2 GDPGR_{it} + \gamma_3 WGI_{it} + \gamma_4 INTCP_{it} + \delta_1 PKSFit + \delta_2 GOVT_{it} + \delta_3 DON_{it} + \delta_4 MFIB_{it} + \delta_5 BANK_{it} + \epsilon_{it} \quad (1)$$

Where; subscripts i represents an MFI and t is the respective year. ϵ_{it} is the error term in the model. β , γ and δ are the coefficients that we are interested to estimate. Specifically, the institutional characteristics includes age of the MFIs (AGE) since its establishment to capture the effect of experience in technological change and innovations. We also included AGE^2 to see if there is any non-linear relationship to evaluate the effect of 'learning curve'. Return on asset (ROA) is also included to examine if the profitability could have any effect on TC. Size of an MFI represented by total number of branches (BRANCH) also included as the usage of technology and innovations among large and small scale MFIs may varies. Another important institutional characteristics of an MFI, location (LOC), a dummy variable if the headquarter of an MFI is located in Dhaka, to examine locational advantages of MFIs on TC. Then, we have included five important sources of funds in the operation of MFIs to examine whether they have any effect on the TC or otherwise. For example, we included concessionary and government subsidies, such as funds from government (GOVT) and PKSFI. We expect that this types of loans will enhance innovative practices among MFIs as they have flexible terms and conditions. To examine how effective the donations to promote innovations and development, we also includes donations (DON) received by MFIs in Bangladesh. Among other source, then we looked into the peer borrowing among MFIs (MFIB) to investigate whether there is any effect on joint innovations and development. Lastly, the hardcore debt from commercial bank (BANK) also included to examine its role in the TC of MFIs in Bangladesh. Furthermore, other macroeconomic factors, such as, Inflation (INF), GDP growth (GDPGR), WGI and interest rate cap (INTCP) also included to examine the effect

of macroeconomic factors on TC. Lastly, the external sources of funds also included in the model.

Results and discussion

The results from the TFP decomposition are reported in Table 1, which reveals that average productivity progress is due to changes in TEC, namely enhancements in management practices and diffusion of technology (Alam, 2001). The sector has been operating for more than three decades and most of the managers/administration have attained their ‘know-how’ through the ‘learning by doing’ process. The improvement in TEC can be further related to enhancement in intellectual capital as a form of human capital. Then, if we look at the TC, it is evident that in general, there is a regress of 2.4 percent per annum during the study period. As such, if MFIs could enhance its TC, then the overall productivity of MFIs will significantly increase, which in turn ensure the resource efficiency to cater poor people in the country. That is why, we looked into the factors that could enhance TC of MFIs in this study.

Table 1 Overall TFP Changes of MFIs in Bangladesh (2009-2014)

Year	TEC	TC	PTE	SE	TFP
2009-10	1.150	0.927	1.064	1.081	1.066
2010-11	1.086	0.978	0.999	1.087	1.062
2011-12	0.960	1.081	1.006	0.954	1.038
2012-13	0.928	1.095	0.967	0.960	1.016
2013-14	1.207	0.826	1.071	1.127	0.998
Mean	1.061	0.976	1.021	1.039	1.036

As discussed earlier, TC is treated as dependent variable and Equation 1 has been estimated by both the OLS and truncated bootstrapping based on the existing literature and reported in Table 2. The explanatory power of the models is reasonably good, as 50 percent of the variations in TC can be explained by the selected independent variables. Apart from that, the overall significance of the models is also satisfactory as both Wald- χ^2 (χ^2) and F-statistics are significant at the 0.01 level.

Since the size of an MFI (measured by number of branches) has a positive effect on TC, it is likely that larger MFIs are the main players in innovation and usage of modern capital and equipment in operations. This suggests that “size matters” for technological progress in the microfinance industry. The findings are also corroborated by earlier arguments that leading MFIs innovate different financial products and small-scale MFIs follow their lead in most of the cases. Additionally, a large number of branches could also represent a decentralized organizational structure; decentralization of microfinance operations could

enhance TC as the branches would have the autonomy to actualize innovative ideas and implement local solutions to use their scarce resources more efficiently.

Table 2 Determinants of technological change

	Dependent Variable: Technological Change			
	OLS	OLS	Truncated Bootstrapping	Truncated Bootstrapping
Institutional Characteristics				
LNAGE	-0.0006 (0.0060)	-0.0005 (0.0060)	-0.0006 (0.0059)	-0.0005 (0.0060)
LNEAGE2		0.0002 (0.0012)		0.0002 (0.0012)
ROA	0.0004 (0.0007)	0.0004 (0.0007)	0.0004 (0.0007)	0.0004 (0.0007)
LNBRANCH	0.0083*** (0.0021)	0.0082*** (0.0021)	0.0083*** (0.0021)	0.0082*** (0.0021)
LOC	0.0113* (0.0062)	0.0113* (0.0062)	0.0113* (0.0063)	0.0113* (0.0063)
Macroeconomic and Regulatory Variables				
INF	-0.0204*** (0.0028)	-0.0204*** (0.0028)	-0.0204*** (0.0028)	-0.0204*** (0.0028)
GDPGR	0.0726*** (0.0098)	0.0727*** (0.0098)	0.0726*** (0.0098)	0.0727*** (0.0098)
WGI	-1.8683*** (0.0759)	-1.8683*** (0.0759)	-1.8683*** (0.0760)	-1.8683*** (0.0760)
INTCP	-0.0618*** (0.0108)	-0.0619*** (0.0108)	-0.0618*** (0.0110)	-0.0619*** (0.0110)
External Sources of Funds				
PKSF	0.0002 (0.0001)	0.0002 (0.0001)	0.0002 (0.0001)	0.0002 (0.0001)
GOVT	-0.0001 (0.0007)	-0.0001 (0.0007)	-0.0001 (0.0007)	-0.0001 (0.0007)
DON	-0.0000 (0.0006)	-0.0000 (0.0006)	-0.0000 (0.0006)	-0.0000 (0.0006)
MFIB	0.0011** (0.0005)	0.0011** (0.0005)	0.0011** (0.0005)	0.0011** (0.0005)
BANK	0.0003 (0.0003)	0.0003 (0.0003)	0.0003 (0.0003)	0.0003 (0.0003)
<i>Cons</i>	-0.8830*** (0.0726)	-0.8839*** (0.0729)	-0.8830*** (0.0717)	-0.8839*** (0.0720)
<i>N</i>	1009	1009	1009	1009
<i>F</i>	74.189***	68.9619***		
<i>Wald Chi2</i>			992.5186***	995.4636***
<i>R2</i>	0.4951	0.4951		
<i>Adj. R2</i>	0.4885	0.4880		
<i>Number of Iteration</i>			2000	2000

Notes: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Robust standard errors are calculated under OLS.

Another important finding which emerged from Table 2 is the significance of location of MFIs in technological change. The coefficient sign is positive and significant at the 0.10 level, which means that MFIs located in Dhaka are estimated to have better TC due to locational advantages and market difference, as Dhaka is the capital city of Bangladesh. Macroeconomic variables play a significant role in explaining variations in TC as well. The overall economic growth supports technological progress in MFIs. This means that in the face of rising economic growth, firm and institutions are likely to invest in better capital equipment to attain technological progress. Interestingly, WGI, INTCP and INF have significant negative effects on TC. Although WGI is expected to have a positive effect on TC, the findings are in contrast with a priori expectations. Since the coefficient of peer borrowing is positive and statistically significant, there is a possibility of shifting required technology between the peer MFIs. These findings can be explained in two ways. First, financially-sustainable and high-performing MFIs will only be lending to low-performing MFIs. Peer borrowing can be from a single or multiple MFIs, depending on the financial needs and capacity of the borrowing MFI. Second, innovations and developments may be determined by joint cooperation and co-development.

Conclusion

After decomposing the TFP index, this study found that on average TC observes regress. This is mainly because the incorporation of innovations in MFIs is quite rare due to their preference for absorbing existing best practices. Thus we observe regress in TC that warrants the necessity of immediate attention in technological development. In view of this, products innovations are imperative in microfinance similar like conventional banking for MFIs to provide services to the unbanked and poor. Therefore, the utilization of ICT into daily financial operations should be encouraged as a policy to boost technological progress in MFIs, which could be advanced by looking into the domestic banking sector as they have led technological advancement in the country at large. Furthermore, this study also identified the factors that can promote technological change and innovations in the microfinance industry.

For example, only MFIB – among other quasi-equity sources of funds positively affect TC. This shows the existence of peer effect. While the size positively affects TC-representing that bigger MFIs are leading in technology usage and innovations. In particular GDP growth has exhibited a positive effect on TC, implying the importance of good economic environment to nurture productivity enhancement through innovations and technological advancement.

Keywords: *Innovation, microfinance institution, technological change, total factor productivity.*

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