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Technological Innovations in Microfinance Institutions in the Three Northern Regions of Ghana

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Authors' contributions

Both authors contributed tremendously to the study. Author SKD wrote the protocol, supervised data collection, performed data entry, and discussed results on the structure of MFIs, the adoption of technological innovations, and challenges hindering innovativeness. Author HI wrote the introduction, designed the study, performed the statistical analysis, and discussed results on the relationship between adoption of technological innovations and the characteristics of MFIs, wrote the conclusion, and the abstract. Both authors read and approved the final manuscript.

Research Article

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ABSTRACT

Microfinance institutions (MFIs) in the three northern regions of Ghana continue to find ways of meeting the aspirations of the poor. One way they try to achieve this goal is by adopting technological innovations. This paper explored technological innovations in a sample of 41 MFIs drawn from the three northern regions of Ghana. Chi-square test was used to test the relationship between characteristics of MFIs and the adoption of technological innovations. The Spearman's rho was used for robustness checks. The findings revealed that computer based technology is the most widely adopted technology followed by telephone, counting machine, internet, satellite, fax machine, and ATM in that order. The study found the adoption of these technological innovations to be significantly related to factors such as board size, number of males in board, board tenure, frequency of board meeting, size of workforce, number of employees with tertiary education, investment in R&D, number of branches or outlets, and sources of funding. According to the MFIs, government policy, competition, regulatory and legal environment, infrastructure and firm specific factors such as client exit rate, human resource capacity and

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distributional challenges affect their innovative behaviour. A key recommendation flowing out of the study is that, much as the adoption of technological innovation is good, it must be done with caution. A thorough risk assessment must be conducted by MFIs prior to the introduction of any new technology.

Keywords: Technological innovations; chi-square; pearson's rho; microfinance; Northern Ghana.

1. INTRODUCTION

Since the 1980s, microfinance has become an important part of development, poverty reduction and economic regeneration strategies around the world. Microfinance Institutions have evolved over the years. By the early 21st century, microfinance institutions (MFIs) had become a vast global industry, comprising large numbers of governments, banks, aid agencies, Non-governmental Organisations (NGOs), cooperatives and consultancy firms. The initial excitement about microfinance, in most part, centred on Bangladesh's much extolled Grameen Bank, which promulgated a 'bottom-up' approach that made the social mobilisation of marginalised communities, and particularly women, a main focus. Many different models of microfinance now exist, and the main activity is focused on providing microfinancial services, rather than the grander goal of social transformation. Microfinance today is about drawing the benefits of contemporary capitalism down to those with low incomes, rather than promoting alternatives to capitalism [1]. It is an embodiment of the post-Washington Consensus [2] and not an alternative to the orthodoxy [1].

In this global age, new technologies are redefining financial services delivery in innumerable ways, and they have the power to present significant opportunities to microfinance institutions (MFIs). Elsewhere in the world, some microfinance institutions already have automated teller machine (ATM) networks, smart card operations, and sophisticated computing technology, all of which greatly enhance efficiency and customer satisfaction. A significant number of MFIs are still reluctant to apply new technologies and prefer to stick to tried-and-tested pre-technology ways [3]. Arun and Hulme [1] have argued that, there are quite a number of late adaptors in the microfinance sector. This slowness in the adoption of technology has cost and efficiency implications for the lagging MFIs. This problem of MFIs in managing technology is summarised by EMN IT & Innovation Working group [4] in the following quote:

"Technology is consistently cited as one of the greatest challenges faced by MFIs around the world. While efficient use of technology can help reduce costs, improve efficiency, and increase outreach, many MFIs still find it difficult to harness the potential and avoid the pitfalls!"

According to the Economist [5], these technological changes have made it easier to address two main obstacles in providing financial services to poor people – managing information, and service delivery costs. The challenge for MFIs is to rethink their business models and to innovate with the ways they deliver and receive services, so that products are more convenient and cheaper for customers, services can be accessed by people in remote areas, and security is enhanced. Until now, the predominant use of technology among MFIs has been to internally manage information. However, technology has an immense potential in other areas, such as payment services and credit underwriting. For instance, as mobile phone usage expands, opportunities to provide financial services in remote rural areas

become feasible. The concept of mobile banking, 'M-banking', has great promise [1]. According to Hishingsuren [6], ICT provides several benefits to clients and MFIs in various countries. The benefits to clients include but not limited to, access to banking services, more convenient services, faster loan processing, less time in queues; and for MFIs, reduced transaction costs, less fraud, improved quality of financial information, increased outreach, reduction in operational costs, and increase in customer satisfaction and loyalty [6].

As MFIs attain an increasing importance in northern Ghana, researchers develop models to measure the extent of innovations in these institutions. For instance, a recent study by Dary and Issahaku [7] explored innovation by MFIs in northern Ghana. The study found that, MFIs in the three northern regions have introduced several innovations in the past 3 years. These innovations, which have been adopted in varying degrees, include product innovation (savings, and loans), marketing innovations, microinsurance, location innovation, and R&D innovation. The authors on the basis of the introduction of new loan products in the past 3 years, found that, 4.9%, 39%, 36.6%, and 19.5% of MFIs were potential innovators, slow innovators, moderate innovators and high innovators respectively. The study further established significant relationship between company characteristics such as frequency of board meetings, educational profile of staff, ownership structure, number of branches/outlets, years of operation, company location, and some indicators of innovation. The adoption rate of microinsurance was found to be very low (14.6%) among MFIs. The authors however failed to capture technological innovations adopted by MFIs in northern Ghana. In a similar study, Issahaku, Dary, and Ustarz [8] established the relationship between financial characteristics and innovations by MFIs in northern Ghana. Employing a combination of Analysis of Variance (ANOVA), multiple regression, and binary logistic regression, the study revealed that the loan repayment rate, and interest rate affect the introduction of new savings products, and number of branches. Also, sources of funding involving bank funding, and equity of owner were found to stimulate the development of new loan products by MFIs in northern Ghana. The study however also has a weakness. It failed to incorporate technological innovations in the analysis. The present study plugs this loophole by covering technologies such as computer, internet, fax machine, and telephone based technologies employed by MFIs in northern Ghana.

Informal sources of credit remain the major source of loans for households in Ghana. According to the Ghana Living Standard Survey (GLSS) 5 (Table 1), the highest source of loan procured by households is relatives, friends or neighbours, with the proportion of loan recipients higher among male-headed households (56.3 %) than among female-headed households (50.4%) in all localities. In rural savannah where the three northern regions are based, 67.1% of male-headed households borrow from relatives, friends or neighbours, while among their female counterparts, 49.5 % borrow from relatives, friends or neighbours. The second highest source of loan is the trader with more females (19.9%) than males having access to loans from traders. The third major source of loan reported is state banks. About three in twenty male-headed households (15.3%) and about one in ten female-headed households (7.9%) that reside in other urban areas have loans from state banks. Less than 10 per cent of the rural household population receives loans from state bank, both among male- and female- headed households. While these statistics are symptomatic of limited access to formal credit, it also reveals a significant capacity to save in rural areas, which in turn has generated a strong but largely unanswered demand for rural deposit facilities. This represents an opportunity for MFIs in particular to expand their services to the largely underserved households in the north. And for this to happen, MFIs must embrace low-cost technologies.

Table 1. Sources of loans to households, by sex of head and locality

Type of facility	Accra (GAMA)		Other Urban		Rural Coastal		Rural Forest		Rural Savannah		Ghana	
	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.
State bank	10.8	6.7	15.3	7.9	2.7	8.4	9.0	3.7	8.0	7.6	10.1	6.5
Private bank	7.1	7.9	10.7	6.9	6.7	2.0	6.8	5.6	2.8	4.9	7.2	5.7
Cooperative	3.0	1.1	3.2	4.8	6.9	2.0	4.6	3.8	3.9	4.1	4.2	3.8
Govt Agency	2.6	1.1	0.7	2.8	2.2	6.8	1.4	1.0	0.7	2.4	1.2	2.5
NGOs	1.1	1.3	0.6	2.0	0.8	0.5	0.4	1.6	0.5	7.0	0.6	2.3
Business firm	0.6	0.0	2.4	1.7	0.0	0.0	0.9	0.2	0.2	0.9	1.1	0.8
Employer	6.6	2.4	0.8	0.0	3.0	0.0	0.8	0.2	0.4	0.6	1.3	0.3
Money lender	0.0	11.2	2.8	2.2	2.5	6.3	5.7	4.2	0.7	3.7	3.2	4.2
Trader	1.8	11.2	8.1	19.8	16.1	19.0	13.5	24.6	9.6	14.2	10.7	19.9
Farmer	0.0	0.0	0.2	0.7	1.3	1.2	3.2	3.6	3.9	1.7	2.1	1.8
Relative/friend/ Neighbor	64.3	56.5	54.1	48.2	55.9	53.9	51.0	50.3	67.1	49.5	56.3	50.4
Other	2.0	0.6	1.2	2.9	1.8	0.0	2.7	1.1	2.2	3.4	2.0	1.8
All	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: GLSS 5

As Arun and Hulme [1] have noted, the application of low-cost, ICT-based services significantly enhances the likelihood of product development for poor populations, and the recent upturn in African economic growth rates improves MFI prospects. The adoption of appropriate technology not only enhances the efficiency of MFIs, but also benefits customers through greater outreach and product diversification.

Even though microfinance itself is not new, research in technological innovations in MFIs is a novelty. Recent studies (eg. Ahlin, Lin, and Maio [9]; Bartual-Sanfeliu, Cervelló-Royo, and Moya-Clemente [10]; Gutiérrez-Nieto, Serrano-Cinca, and Mar-Molinero [11]) have tended to focus on the performance of MFIs while ignoring the role of innovations. Such paucity of research in technological adoption in MFIs in Ghana is not good for the growth of the microfinance sector. In this modern era, research definitely has its own place in the development of all sectors, the microfinance sector inclusive. Research draws the attention of both internal and external stakeholders to the goings-on in a particular sector for remedial measures to be taken. It also paves the way for discoveries and is itself a means of discovery. In other not to deprive the microfinance sector of these benefits, this research answers this call by exploring the adoption of technologies by a sample of 41 MFIs situated in the three northern regions (Northern, Upper East and Upper West regions) of Ghana. These regions are chosen because they house the majority of the poor in Ghana [12]. And since microfinance is finance for the poor, there can be no better place in Ghana to conduct such a study. Apart from examining technological innovations, this study distinguishes itself from the extant literature by establishing the relationship between some characteristics of MFIs and the adoption of technological innovations. This is to make MFIs and other stakeholders aware of some the factors that impinge on the adoption of technological innovations so that they can intervene where appropriate. Further, this study waves into the arena of factors that affect innovations in general, from the perspective of MFIs themselves. Thus, the three-fold objectives of the study are:

1. To examine the adoption of technological innovations by MFIs in northern Ghana
2. To establish the relationship between the adoption of technological innovations and the characteristics of MFIs
3. To unearth the perception of MFIs about factors that hinder innovative behaviour

2. METHODOLOGY

2.1 Data Collection

The study focused on microfinance institutions in the three northern regions of Ghana comprising Upper East, Upper West and Northern. The microfinance institutions considered were rural and community banks, cooperative credit unions and savings and loans associations. Seventy (70) questionnaires were distributed to microfinance institutions across the regions. Out of this number, 50 questionnaires were retrieved, representing 71% response rate. However, nine institutions responded partially to the questionnaires, hence restricting the use of their data for analysis. Therefore, this study is based on the analysis of data of 41 microfinance institutions from 13 administrative districts in the study area. Table 2 presents the types and distribution of sampled microfinance institutions for the study.

Table 2. Types and distribution of microfinance institutions sampled

Region	Type of MFI	Frequency	Total
Northern Region	Rural Banks	3	14
	Cooperative Credit Unions	6	
	Savings & Loans Associations	5	
Upper East Region	Rural Banks	2	14
	Cooperative Credit Unions	5	
	Savings & Loans Associations	7	
Upper West Region	Rural Banks	4	14
	Cooperative Credit Unions	5	
	Savings & Loans Associations	5	
Total			42

2.2 Data Analysis Techniques

Objective one, which seeks to explore technological innovations, was analysed using descriptive statistics such as frequencies and percentages. Objective two which examines the relationship between the characteristics of MFIs and the adoption of technological innovations was analysed using chi-square test. The chi-square test is one of the most useful nonparametric tests. Its parametric counterparts include t-test for matched pairs, t-test for independent samples, F-test with Analysis of Variance (ANOVA), and the Pearsonian correlation coefficient. But unlike its parametric counterparts, chi-square test does not require that (1) the population be normally distributed, (2) the difference between samples be normal, (3) the sample means be normally distributed, (4) the distribution of the two variables being compared be normal [13]. Thus, the use of chi-square is not contingent on our knowledge about the distribution of the population from which the sample is drawn. Among the two most common applications of chi-square: goodness-of-fit tests and tests of independence, this study employs the test of independence. The hypothesis tested is:

H₀: the characteristics of MFIs and the adoption of technological innovations by the same are independent

H₁: the characteristics of MFIs and the adoption of technological innovations by the same are not independent

The chi-square test is given by the formula:

$$\chi^2 = \sum_{i=1}^{rc} \frac{(O_i - E_i)^2}{E_i}$$

Where O_i is observed frequency, E_i is expected frequency. The degrees of freedom is $(r-1)(c-1)$. Where r is the number of rows and c the number of columns. The theoretical chi-square value is read from the chi-square table and compared to the computed value. If the computed value is greater than the theoretical value, the null hypothesis is rejected and vice versa. To perform robustness checks, the Spearman's rho statistics (nonparametric correlation test) was also computed.

Finally, the last objective, which seeks to unearth the challenges that affect the innovative behaviour of MFIs was analysed using descriptive statistics. The resulting analysis was then presented in a table for easy understanding and interpretation.

3. RESULTS AND DISCUSSION

3.1 Ownership and Organisational Structure of Microfinance Institutions

Microfinance institutions can assume various ownership and organisational forms, which may also vary from country to country due to differing regulatory requirements and categorizations that may be in operation. The ownership and organisational forms of MFIs is an important subject as they impact on the efficiency of governance of MFIs. Table 3 presents the ownership and organisational structure of MFIs sampled based on the Ghanaian context. Among the MFIs considered, 41.5%, 39% and 19.5% respectively were owned by private individuals, individuals and organisations, and communities in conjunction with Bank of Ghana. In terms of organisational structure, private limited liability companies, cooperative societies and public limited liability companies are also 41.5%, 39% and 19.5% respectively. The results show that most of the MFIs in northern Ghana are owned by individuals and are mostly private limited liability companies and cooperative societies.

Rural Banks are public companies owned by communities (with capitalization assistance from the Bank of Ghana), registered and licensed as unit banks (no branching privileges) under the provisions of the Banking Law. The operations of Rural Banks are limited to a clearly-defined geographical (rural) area, and are permitted to offer banking services limited to loans and to checking, savings and time deposits. Savings and loans companies which fall under private limited liability companies are deposit-taking financial institutions regulated by the Bank of Ghana under the Non-Bank Financial Institution (NBFI) Law 1993 (PNDCL 328), with a minimum capital requirement much lower than that of the universal banks but above that for rural and community banks. Credit unions are registered by the Department of Cooperatives as cooperative thrift societies in Ghana and are permitted to accept deposits and give loans to their members only.

Table 3. Ownership and organisational structure of microfinance institutions

Category	Classification	Frequency	% Frequency
Ownership Structure	Community/Bank of Ghana	8	19.5
	Individuals and Organisations	16	39
	Private Individuals	17	41.5
Total		41	100
Organisational Structure	Public Limited Liability Company	8	19.5
	Cooperative Society	16	39
	Private Limited Liability Company	17	41.5
Total		41	100

3.2 Adoption of Technological Innovations among MFIs

Technological innovation is very crucial for the evolution and expansion of other innovations in microfinance; -product, process, marketing and organisational innovation. According to Nugroho and Miles [14] technological innovation can be, and has been, exploited to improve the efficiency, scale and quality of microfinance services. They presented technological

innovations adopted by MFIs and contained in Microfinance Gateway (CGAP) catalogue to include Automated Teller Machines (ATMs), Interactive Voice Response (IVR) Technology, Smart Cards, Personal Digital Assistants (PDAs), Biometrics Technology, and Credit scoring systems. Among the microfinance institutions studied in this paper, all these technological innovations were absent except ATMs, which only 2.4% representing one institution has adopted in its microfinance services delivery. This confirms the statement by Gupta [15] that the microfinance industry in most African countries remains largely underdeveloped.

As presented in Table 4, the technological innovations found among MFIs include computers, counting machines, telephone services, ATM, internet services, and satellite technologies for radio and TV receptions with varying degrees of adoption. The level of adoption of computers and associated software, internet technologies, ATMs, counting machines, fax machines, telecommunication technologies and satellite infrastructure are 98%, 51%, 2.4%, 59%, 20%, 85.4% and 29% respectively. The number of MFIs with computers in this study is higher than the 88% found among Ugandan MFIs [16]. Thus, computer based technology is the most widely adopted technology followed by telephone, counting machine, internet, satellite, fax machine, and ATM in that order. Although these technologies can be considered basic for the effective functioning of any MFI in the 21st Century, the level of adoption of some of the technological innovations is quite low and this will in no doubt affect the efficiency of service delivery and other innovations that can occur within these institutions. It can be argued that most of the MFIs are relatively young (averaging 7 and half years in operation), small in size, and small number of clients. This may affect the type and level of adoption of technological innovations by these institutions. Generally, most MFIs in Ghana (like in other African countries) are undercapitalized to make investments in some technological innovations such as ATMs which are capital intensive and also require high level of expertise to operate and maintain. Where resources permit, especially considering the clients these MFIs deal with (mostly low income, assetless individuals whose business activities are low-return activities), the cost-return analysis must be examined critically before such investments are made. This will prevent losses to the MFIs and their clients.

Table 4. Adoption of technological innovations among MFIs

Technological Innovation	Frequency	% of MFIs
Computers	40	98
Internet services	21	51
ATM	1	2.4
Counting machines	24	59
Fax machines	8	20
Telephone services	35	85.4
Satellite	12	29

Particularly, internet-based technology is an essential tool in the hands of MFIs since it presents multi-purpose uses. MFIs can use the Internet to have active discussions with their clients, donors, staff and volunteers or to facilitate business-to-business collaboration. Internet-based technologies may also be used by MFIs to provide financial and non-financial services; monitoring and coaching purposes; or for satisfying group lending needs [4].

In this age of increasing mobile penetration, MFIs in northern Ghana can harness mobile technology to improve their efficiency and serve their clients better. MFIs in northern Ghana

can use mobile phones for book keeping, receive and send payments, and pay utility bills similar to what is reported among MFIs in India [16].

3.3 Characteristics of MFIs and the Adoption of Technological Innovations

The second objective of this paper is to establish, if any, the relationship between the characteristics of MFIs and their adoption of technological innovations. To achieve this objective, chi-square tests was performed between all company characteristics in the data and each technological innovation. Only results of significant relationships have been extracted and presented in Table 5. To provide robustness checks, results of correlation analysis are also presented.

Table 5. Firm characteristics and technological innovations –chi-square tests

Type of Technological Innovation/Variable	Value	Sig.
Computer Technology		
Board size	38.00	.000***
No. of males in board	38.00	.000***
Internet Technology		
Type of MFI	5.95	.051*
Owner equity	3.08	.079*
ATM		
Bard tenure	15.84	.004**
Size of workforce	41.00	.000***
Donor funding	7.38	.007***
No. of employees with tertiary education	18.99	.025**
Counting Machine		
Freq. of board meetings	12.28	.015**
Bank funding	4.78	.026**
Owner equity	4.14	.042**
Fax Machine		
No. of branches	19.12	.039**
No. of employees with tertiary education	18.29	.032**
Investment in R&D	3.49	.062*
R&D expenditure	29.71	.013**
Telephone		
No. of employees with tertiary education	19.19	.024**
Investment in R&D	3.67	.049**
Donor funding	2.93	.087*
Shares	3.36	.067*
Satellite		
Shares	3.48	.062*

***, **, * means significant at 1%, 5%, and 10% respectively

3.3.1 Computer technology and characteristics of MFIs

Based on the chi-square test, the adoption of computer technology is significantly related to the characteristics of the firm such as size of board, number of males serving in board, and the number of branches operated by the MFIs. The correlation analysis test (Table 6)

however shows that number of branches is not significant. The positive correlation coefficient values imply that as board size, and number of males in board increase, the procurement of computers also increases. Board size is usually linked to the size of the organisation and most are male dominated. Therefore, as the organisation grows bigger, in order to be efficient, more computers and computer related infrastructure will have to be rolled out. This supports the findings of Camelo et al. [17] and, Damanpour and Schneider [18] that, the size of a company is positively related to the adoption of innovation.

Table 6. Computer technology and characteristics of MFIs -Spearman's Rho

	Correlations	Computer technology	Board Size	Males on board	Number of branches
Computer Technology	Correlation coefficient	1.00	.287	.281	.167
	Sig. (2-tailed)	-	.080*	.087*	.279
	N	41	38	38	38

**means significant at 10%*

3.3.2 Internet technology and characteristics of MFIs

From the chi-square test, the adoption of internet based technology such as WAN, LAN, and the development of website is significantly related to the type of MFI in question and funding from owner equity. The counterpart correlation test totally confirms this relationship and gives the direction to be positive (Table 7). Of particular relevance is the contribution of owner equity to the adoption of internet technology. MFIs financed by owner equity are more likely to adopt internet technology. This may be due to the flexibility in the application of this source of funding relative to other funding sources such as donor, and bank funding. "Technology is changing at a great pace. So are the needs of businesses. If microfinance institutions are to keep up with the ever-changing demands, they have to invest heavily into the latest technologies" [4]. But funding is one key factor that inhibits the adoption of innovations [16]. Innovative means of financing must be explored by MFIs to augment existing funding sources for purposes of investing in the appropriate technology.

Table 7. Internet technology and characteristics of MFIs –Spearman's Rho

	Correlations	Internet Technology	Type of MFI	Owner Equity
Internet Technology	Correlation coefficient	1.00	.340	.320
	Sig. (2-tailed)	-	.030**	.042**
	N	41	41	41

***means, significant at 5%*

3.3.3 ATM and characteristics of MFIs

Through ATM, mobile banking and Point of Sale (POS) networks among others, ICT is being used to facilitate branchless banking [16]. The chi-square test has established the existence of a significant relationship between the adoption of ATM and the characteristics of MFIs such as board tenure, size of workforce and the number of employees with tertiary education. The finding of a significant relationship between the adoption of ATM and number of employees with tertiary education agrees with the findings of Camelo et al. [17] that the

level of education of employees stimulates innovations. The operation and maintenance of ATMs is complex and requires highly educated and well-trained staff to manage them. The correlation test (Table 8) however fails to establish a significant relationship between the adoption of ATM and size of workforce and the number of employees with tertiary education. Board tenure remains significant with a positive influence. This implies that security of board tenure enhances the adoption of ATM. This is because, the board is able to implement tough and innovative decisions without worrying about being fired immediately. Also, as argued by Simeon [19], a longer tenure allows board members more time to “accumulate the strategic expertise required for complex decision-making and multimarket operations”. Other researchers [20,21] argue to the contrary that, a longer tenure socialises board members into accepting things as they are and make them less likely to adopt new ways of doing things.

Table 8. ATM and characteristics of MFIs –Spearman’s Rho

	Correlations	ATM Technology	Board Tenure	Size of Workforce	No. of Emp. with Tertiary Educ.
ATM Technology	Correlation coefficient	1.00	.312	.228	.255
	Sig. (2-tailed)	-	.082*	.151	.118
	N	41	32	41	39

*means significant 10%

3.3.4 Counting machine and characteristics of MFIs

The use of counting machine is significantly linked to the frequency of board meetings, bank funding and equity funding per both the chi-square and the correlation tests. But while the relationship between the adoption of counting machine and frequency of board meeting is positive, it is negative for bank funding and owner equity (Table 9). Funds from the banking sector usually come at a higher cost and MFIs may perceive that, investing such moneys on counting machines may not yield returns high enough to meet the cost. It is surprising however that funding from owner equity has a negative relationship the purchase. The explanation may be that owner equity may be not be enough and for that matter MFIs rely on other sources to buy counting machines. Another plausible explanation is that most MFIs meet customers on the street, at their homes, and work places where the use of a counting machine may be counterproductive.

Table 9. Counting machine and characteristics of MFIs –Spearman’s Rho

	Correlations	Counting Machine	Frequency of Board Meetings	Bank Funding	Owner Equity
Counting Machine	Correlation Coefficient	1.000	.497	-.348	-.318
	Sig. (2-tailed)	-	.003***	.026**	.043**
	N	41	34	41	41

***, ** means significant at 1% and 5% respectively

3.3.5 Fax machine and characteristics of MFIs

There exist a significant relationship between the number of fax machines and number of branches, number of employees with tertiary education, whether firm has made R&D investment, and R&D expenditure based on the chi-square test. R&D expenditure is however insignificant based on the Spearman's rho (Table 10). The signs of number of branches, number of employees with tertiary education, and R&D investment are positive implying that they have a positive relationship with the number of fax machines used by MFIs. The plausible explanation is that, as the number of branches increase, the need for inter branch communication and, branch and headquarters communication increases, which will call for more fax machines. Also, some appreciable level of education is required for the use and management of fax machines. R&D investment usually precedes the opening of new branches, and new branches require appointing managers who are usually highly educated to man the branch and also oversee communication with internal and external stakeholders.

Table 10. Fax machine and characteristics of MFIs –Spearman's rho

	Correlations	Fax Machine	No. of Branches	No. Emp. with Tertiary Educ.	R&D Investment	R&D Expenditure
Fax Machine	Correlation coefficient	1.00	.245	.324	.292	.232
	Sig. (2-tailed)	-	.123	.044**	.064*	.162
	N	41	41	39	41	38

*** , * means significant at 5% and 10% respectively*

3.3.6 Telephone technology and characteristics of MFIs

In this world of communication, fixed and mobile telephoning have become imperative to the success of the modern organisation. Through telephones, MFIs communicate with internal and external stakeholders. Even research can be conducted via phone telephone interview. The chi-square test reveals that, the adoption of telephone technology is significantly related to the number of employees with tertiary education, R & D investment and funding sources such as donor, and shares. The correlation test in Table 11 confirms this relationship. But while the relationship is positive for number of employees with tertiary education, it is negative for the funding sources. Most MFIs acquire mobile and fixed telephones especially for top management who are usually holders of a tertiary degree, hence, the positive relationship between employees with tertiary education and number of telephones. In some cases, employees who wish to make calls will have to do so at the manager's desk. Sometimes, this is a ploy to reduce the amount of resources spent on telephone bills. It is also to check a situation where staff use company resources to finance calls that are personal in nature. The negative relationship between funding through donor and shares and the number of telephones implies that, these funding sources are not used to purchase telephone infrastructure and or defray telephone bills. Donors in particular usually specify the specific area the funds should be spent.

Table 11. Telephone technology and characteristics of MFIs –Spearman's Rho

	Correlations	Telephone Technology	No. Emp. with Tertiary Educ.	R&D Investment	Donor Funding	Funding from Shares
Telephone Technology	Correlation coefficient	1.00	.320	.307	-.267	-.286
	Sig. (2-tailed)	-	.047**	.051*	.091*	.070*
	N	41	39	41	41	41

***,* means significant at 5% and 10% respectively*

3.3.7 Satellite technology and characteristics of MFIs

The adoption of satellite based technology relates significantly to funding through shares on the basis of the chi-square test. The correlation analysis shows the existence of a significant negative relationship implying that when there is an increase in funding through shares, there is a decrease in the adoption of satellite technology (Table 12).

Table 12. Satellite technology and characteristics of MFIs -Spearman's rho

	Correlations	Satellite technology	Shares
Satellite technology	Correlation coefficient	1.00	-.294
	Sig. (2-tailed)	-	.065*
	N	41	41

** means significant at 10%*

3.4 MFIs' Perceptions on Factors that Affect Innovative Behaviour

Based on their history and experience, MFIs have perceptions regarding the factors that affect their ability to adopt innovations of all kinds be they product, market, incremental, location, process, or technological. Table 13 shows the perceptions of MFIs about factors that hinder the adoption and use of innovations.

Table 13. MFIs' Perceptions on Factors that Affect Adoption and Use of Innovations

Factor affecting innovation	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree
Government policy	9.8	31.7	22.0	22.0	14.6
Competition	2.4	0.0	2.4	51.2	44.0
Client exit rate	9.8	9.8	17.1	53.1	9.8
Liquidity management	2.4	0.0	14.6	63.4	19.5
Distributional challenge	7.3	14.6	31.7	34.1	12.2
Human resource ability	2.4	4.9	14.6	53.7	24.4
Other Firm specific factors	0.0	4.9	24.4	41.5	29.3
Legal/regulatory env't.	7.3	22.0	29.3	24.4	17.1
Infrastructure	17.1	17.1	14.6	36.6	14.6

Note: all figures are in %.

With regards to the effect of government macroeconomic policies on MFIs innovative behaviour, 36.6% of MFIs agree/strongly agree, 41.5% disagree/strongly disagree and 22% are uncertain of the effect of government macroeconomic policies on their innovative behaviour. Government macroeconomic policies whether fiscal or monetary in dealing with inflation, currency depreciation, economic growth and unemployment do affect microfinance services delivery [22], albeit indirectly in most cases. Government can create a policy environment which favours microfinance innovations or it can introduce policy distortions that make it difficult for MFIs to innovate or have sustainable operations [23, 24]. This may largely explain why majority (58.6%) of the MFIs strongly agree/agree and/ or are uncertain about the effect of government economic policies on their services delivery.

As presented in Table 13, client exit rate, liquidity management, distributional challenges, and human resource ability levels are some firm specific factors. Among the MFIs, 63%, 83%, 46.3%, and 78.1% agree/strongly agree that client exit rate, liquidity management, distributional challenges, and human resource ability levels respectively have an effect on their innovative behaviour. The results suggest that MFIs largely perceived these firm specific factors to affect their innovative behaviour, and any measures to encourage innovation among MFIs should also include these firm specific factors.

The results in Table 13 further show that 95.2% of MFIs perceives that competition affects innovative activity while 4.8% does not. It is generally agreed that the nature and intensity of competition does have effect on firms' competitive behaviour [25]. However, literature on the effect of competition on a firm's innovation is divergent; whereas Schumpeter [26] argues that monopoly provides the highest incentives for innovations, Arrow [27] thinks that perfect competition is best for innovation incentives. What is probably important is for firms to understand and critically examine the market structure within which they operate and tailor innovative activity in areas that will enhance their competitive position. The results on perception of the legal and regulatory environment is not clear cut. About 41.5% agrees and 29.3% disagrees while 29.3% are uncertain of the effect of the legal/regulatory environment on their innovative activity. This result is not surprising since the regulatory framework varies depending on the type of MFI and therefore the perception of its effect on innovative activity will also vary among the different categories of MFIs. Rural and community banks are currently regulated under the Banking Act 2004 (Act 673) while the Savings and Loans Companies are currently regulated under the Non-Bank Financial Institutions (NBFI) Law 1993 (PNDC 328). The regulatory framework for credit unions is still being developed to reflect their dual nature as cooperatives and financial institutions, while other players such as FNGOs, ROSCAS, and ASCAs do not have explicit legal and regulatory frameworks, and are largely unregulated [28]. Therefore, cooperative credit unions and savings and loans companies may have certain freedoms such as meeting minimum capital and reserve requirements compared to rural and community banks. However, where the regulatory requirements are high, it can also be a driver for innovation. While licensing and supervision of MFIs by a country's financial authorities is necessary for effective and sustainable microfinance delivery [14], fulfilling this regulatory requirement should not hold back innovation or divert attention away from serving the poor [29] but should rather empower MFIs to deliver social and commercial services to the poor. The presence of key infrastructure, whether internal or external (private or public) is also crucial to innovative activity of organisations. Majority (51.2%) of the MFIs perceive that infrastructure plays a role in their innovative activity. As underscored by Gonçalves and Peuckert [30], quality infrastructure is part of innovation systems. The perceptions of MFIs regarding barriers to innovation behaviour in this study is similar to what has been documented in the literature.

For instance, according to Kotelnikov [31], barriers to the adoption of innovations include legal framework, financing options, human capacity, and infrastructure.

4. CONCLUSION

The paper explored the adoption of technological innovations in MFIs in northern Ghana. These technologies include internet, ATM, fax, computer, telephone, counting machine, and satellite. Computer is the most widely adopted technology followed by telephone, counting machine, internet, satellite, fax machine, and ATM in that order. The use of technology by MFIs is still at its formative stages. MFIs should not rush into adopting technological innovations. They should evaluate technological options available to them and choose the ones that will help them optimise their goals.

This paper further established the relationship between company characteristics and the adoption of innovations by MFIs in northern Ghana. Specifically, the adoption of computer technology is significantly related to the characteristics of the firm such as size of board, number of males serving in board and the number of branches operated by the MFI; the adoption of internet based technology is significantly related to the type of MFI in question and funding from owner equity; a significant relationship exists between the adoption of ATM and the characteristics of MFIs such as board tenure, size of workforce and the number of employees with tertiary education; the use of counting machine is significantly linked to the frequency of board meetings, bank funding and equity funding; there exist a significant relationship between the number of fax machines and number of branches, number of employees with tertiary education, R & D investment and R & D expenditure; the adoption of telephone technology is significantly related to the number of employees with tertiary education, R & D investment and funding sources such as donor and shares; and the adoption of satellite based technology relates significantly to funding through shares. These established relationships provide a guide to microfinance practitioners and academicians alike. Since the adoption of technological innovation is sensitive to sources of funding, it calls for the need for MFIs to develop innovative financing options to complement existing funding sources for the purpose of investing in useful technology. This may require employing the services of professional fund raisers. Also, the established relationship between technological innovations and some characteristics of MFIs requires MFIs to think of how to effectively restructure these factors (characteristics) in a manner that favours the adoption of technology. In this ICT age, an MFI that ignores technology is doomed to fail. The world is now run by technology and so is microfinance.

Also, MFIs hold the perception that government policy, competition, regulatory and legal environment, infrastructure, and firm specific factors such as client exit rate, human resource capacity and distributional challenges cripple their efforts at innovating. Government in particular must continue to stabilise the macroeconomic environment to levels that are conducive to the operations of MFIs. The Bank of Ghana should also put in place the requisite regulatory and legal framework to fortify MFIs and to create an enabling environment for MFIs to adopt modern technology. Firm specific challenges are within the purview of MFIs themselves. The management of MFI should put in place strategies that promote the adoption of technological innovation. Such strategies must be developed out of a participatory process, if every worker must be carried along. The right tool, in the wrong hands, could be useless. Much as the adoption of technological innovation is good, it must be done with caution. A thorough risk assessment must be conducted by MFI prior to the introduction of any new technology. This will enable MFIs to optimise the benefits that these technologies present.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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