

## **Knowledge Gain and Adoption among Farm Women through Interactive Multimedia in Kilosa and Sengerema Districts, Tanzania**

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### **Abstract**

This paper examines knowledge gain and adoption among farm women with access to information and improved communication. This is because access to information and improved communication is a crucial requirement for agricultural development. In rural areas, group approach, “self-help groups (SHGs),” have been initiated among farm women using Interactive Multimedia Compact Disc (IMCD). The IMCD emerged as a potential learning tool to train farmers about a particular agricultural-knowledge. A theoretical and conceptual framework for an adoption pathway is reviewed in which farmers move from knowledge gain to adoption over time. This study was conducted in Sengerema and Kilosa districts with telecentres that train farm women in SHGs using IMCD. A total of 180 farm women were randomly and equally selected. Simple correlation and multiple regressions were used to assess association and influence of socioeconomic characteristics on knowledge gain and adoption. It was established that education status and mass media exposure exhibited a positive and significant relationship. Age and farm statuses showed negative association with knowledge gain. Farm status and innovativeness showed significant and positive relationship with knowledge adoption. Farming experience exhibited negative and significant relationship with knowledge adoption. Thus, while preparing IMCD, one should take care these variables for knowledge gain and adoption. The inferences on knowledge gain and adoption imply that longer periods will be required for majority of farm women to use the technology and to have the decision leading to adoption.

### **Introduction**

Tanzania’s main economic pillar is embedded in the agricultural sector, which supports over 33 million people and contributes 60 percent of the country’s Gross Domestic Product (GDP) as well as 61 percent of export earnings and provides 84 percent of rural employment (Petracco and Sanchez-Reaza, 2018: 14; World Bank, 2019: 10). The agriculture sector is one of the most vital sectors in Tanzania’s economic development and provides employment for majority of the nation’s population. The Tanzania Development Vision has set a target of achieving a level of general living standards typical of medium-income countries by the year 2025. Therefore, according to Chongela (2015: 64), for the agricultural sector to fully contribute towards the sustainable development target, it should grow annually by 7 percent, implying more than doubling the current annual growth rate of 3.3 percent. Likewise, agricultural research systems have a major role to play in

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increasing productivity and profitability of the sector through development of scientific knowledge to generate improved technologies for the production systems (Baffes *et al.*, 2019; McCole *et al.*, 2014: 12). Agricultural extension in Tanzania complements this effort by transferring technologies developed by the National Agricultural Research Systems (NARS) to the end-users.

In Tanzania, agriculture plays an important role as the nation food provider and sources of employments in rural areas. It is dominated by smallholder farmers, dependent on rain-fed production, limited use of improved seeds as well as fertilizers, and the low share of cultivated over arable land (Aker, 2011:632). Furthermore, Tanzanian agriculture is dominated by small and marginal farm women, whose education is weak and majority are often unable to access information that could increase yield for their crops. The farm women play a significant role in domestic and socio-economic life of society such that national development is not possible without developing this important and substantial segment of our society. It is estimated by ILO (2020) that 66 percent of female are employed in agricultural sector in Tanzania, meaning that women comprise majority of the labour force in agriculture. Thus, agriculture comprises a greater part of women's economic activity than men, 81 percent of women, compared to 73 percent of men, are engaged in agricultural activity. In rural areas, that number rises to 98 percent for women. Moreover, in Tanzania, the share of adult population working in agriculture is higher than regional averages, especially for women: 81 percent of the female population works in agriculture in Tanzania, compared to 55 percent for the rest of Sub-Saharan Africa. On the other side, the government has a huge research and development infrastructure in form of institutions such as the Tanzanian Agricultural Universities and other institutes, but today, these institutions are facing many constraints in mobility of technological staffs for transfer of technological information at the village level (Lwoga, 2010: 12; Harris, 2016: 178).

In rural areas of Tanzania, farmers operate in widely distributed rural locations, which deprive them from benefits of timely and useful information from research centres and services organizations (Walsham, 2012: 88). This is because of inadequate dissemination of agricultural technology and its adoption. According to Misaki *et al.* (2018), insufficient extension services and poor access to information further widen the gap in adoption of technology and lead to poor productivity levels. It is known that information on productivity is critical to social and economic activities to foster development process (FAO, 2015: 46). The right information at the right time plays a crucial role for development of Tanzanian agriculture. Here comes the role of Information and Communication Technologies (ICTs), which are powerful and productive with new ideas, methods of technology dissemination and further improving knowledge gain as well as adoption among farmers in the rural areas (Demenongu *et al.*, 2018: 2). Therefore, information and wide access to ICTs is considered as wealth (Emeana *et al.*, 2019: 124). According to Yeboah and Jayne (2018: 810), people want adequate and authentic information as early as possible. In recent years, there is visible shift from old ways to modern ways of information

delivery system (Donner and Escobari, 2010: 641). The ICTs have become a powerful tool for improving service delivery and enhancing local development opportunities (Mojisola and Mbibi, 2007: 99). They are enabling technologies that allow quicker and more efficient exchange as well as processing of information (Lamprey *et al.*, 2016: 904).

During the last two decades, remarkable developments have taken place in information and communication technology in Tanzania. The ICTs tools, like desktop and laptop computers, tablet PCs, cell phones, smart phones, satellite phone, FM radio; multimedia devices like web camera, digital camera, handy cam, data cards, blue-tooth; storage devices like pen drive, CD-ROMs and DVDs; internet café, telecentres, touch screen systems, expert systems; and others have been popular for information exchange (Zewge and Bekele, 2017: 22). Computer and Internet enabled technologies like electronic mail (e-mail), electronic commerce (e-commerce), electronic learning (e-learning), electronic conferencing (e-conferencing), interactive voice response services (IVRS), teleconferencing, video conferencing, computer assessed services, wireless application protocol (WAP) and other online services; mobile enabled services like SMS, MMS, GPRS, web-based GIS, remote sensing, and others, have been generalized among people (Dehnen-Schmutz *et al.*, 2016: 9). Therefore, it is essential to effectively communicate useful agricultural technologies to farmers (Sekabira and Qaim, 2017: 98). Improved communication and access to agriculture information is directly related to empowerment of farming community (Kavaskar *et al.*, 2016: 3447). Moreover, ICTs provide easy access to global information, knowledge gain as well as adoption and they are simple channels for two-way communication (Aldana *et al.*, 2011: 135).

When applied to conditions in rural areas, advanced communication gadgets help to improve communication, increase participation and disseminate information as well as share knowledge and adoption (IFAD, 2010). According to Chauhan and Kar (2019), *cyber extension* will be the major form of technology dissemination in the near future. This is because improved communication and information access is directly related to socio-economic development (Tschirley, *et al.*, 2015: 628). However, farm women in rural areas are generally less responsive to improved techniques since they are not exposed to these techniques (IMF, 2017: 4). Thus, to have the adequate contributors of farm women in development of the country's agriculture, it is imperative that they should be kept abreast with the latest innovations (Godson-Ibeji *et al.*, 2016: 35). In order to upgrade their socio-economic status, the only option today is to improve their agricultural productivity through increasing knowledge levels and adoption of improved technologies to boost up the overall agricultural productivity (Sharmila and Kavaskar, 2017: 92). Therefore, the role of farm women should be given proper emphasis so that desirable changes can be brought about in rural people's life styles (Balraj and Pavalam, 2012: 48). Hence, content development for the new ICTs should be demand-driven and relevant to the needs of the communities so that these technologies are tailor made and are context specific (Ngowi *et al.*, 2015: 93; Ngowi and Mwakalobo, 2017: 9).

With this empirical and theoretical background, the present study had the following specific objectives: to examine farm women's utilization behavior of user-friendly Interactive Multimedia Compact Disc (IMCD) technologies at telecentres for agricultural knowledge gain and adoption; to assess the relationship and the influence of socioeconomic characteristics on farm women towards knowledge gain as well as adoption; and to identify problems faced by farm women in utilizing user-friendly IMCD together with their suggestions for improving the technologies. This is because, according to Lwoga (2010: 12), practically, there are no area in agriculture in which ICTs has no role to play. In light of globalization and the impact of World Trade Organization (WTO) on agriculture as well as agro-based industries, use of information technologies-based services in this field have become imperative (Mojisola and Mbibi, 2007: 99). Access to information and improved communication is a crucial requirement for sustainable agricultural development (Baumüller, 2018: 135). Modern communication technologies, when applied to conditions in rural areas, can help improve communication, increase participation, and disseminate information as well as share knowledge and skills (Baumüller, 2015:14). Therefore, the rapid strides that the country has registered in the information technology field remain incomplete, unless utilized to ensure highly efficient and productive Tanzanian agriculture.

#### **Adoption Pathways: A Theoretical and Conceptual Framework**

At theoretical level, the study borrowed from Bloom's Taxonomy Theory (1956) that encompasses on knowledge, skill and attitude. Knowledge defines facts, information, and skills learned by a person through experience or education (Woodman *et al.*, 1993) or obtained from a particular process through a new idea (Bloom, 1956). According to Bloom (1956), knowledge involves knowledge and development of intellectual skills. This includes remembering or recognition of facts, procedural patterns, and concepts that serve in development of intellectual abilities as well as skills (*ibid.*). There are six categories of knowledge, which are knowledge, comprehension, application, analysis, synthesis and evaluation (*ibid.*).

Skill describes an ability developed by a person through training or experience. Meanwhile, attitude explains the way a person views something or tends to behave towards it, often in an evaluative way. Taxonomy Bloom's Taxonomy Theory stated that the three categories, which are knowledge, skill and attitude, are crucial elements to be acquired before planning to the next phase, for our case, knowledge adoption. For instance, research conducted by Burton and colleagues (2003: 34) examined knowledge effects on implementation of an organic farming technology in United Kingdom. The study was conducted to determine implications of farmers exposed on organic cultivation technology in their agricultural activities (*ibid.*). The study highlighted that knowledgeable farmers in United Kingdom had a tendency to implement an organic farming innovation (*ibid.*). Consistent findings by Sharma (2016: 3) implied that farmers with knowledge on particular technology changed their attitude and they were highly receptive on new technology. The results revealed further that technology adoption depends on farmers' education background and knowledge

(*ibid.*). The knowledgeable farmers were ready to adopt knowledge (Qureshi, 2015: 518).

The logistic frequency distribution framework (Jabbar *et al.*, 2003) depicts a conventional adoption pathway for a new technology. According to this framework, at a point in time, a population of farm women is divided into two groups, adopters and potential adopters (*ibid.*). Furthermore, it is implicitly assumed that the entire population of farm women or a certain ceiling level of the population eventually adopts the innovation and that, once adopted, the innovation is never rejected (*ibid.*). Most agricultural innovations evolve as they diffuse because an innovation may be changed or modified by a user in the process of its adoption and use. When farm women are not involved in the technology generation process, awareness and knowledge gain about a new technology precede any adoption decision. Information gathering and updating information through knowledge gain by doing as well as observation play important roles in the adoption process and there may be a lag between the time when farmers first hear about an innovation and the time when they adopt it (e.g., Feder and Umali, 1993). However, empirical verification of the linkage between knowledge gain and adoption as well as about factors that influence such linkage is rare. Therefore, any adoption decision is preceded by a period of awareness and knowledge gain. Initially, only limited amounts of information may be available or only a limited amount of available information may be digested. The optimal level of information is reached when information acquired over a period of time reaches a threshold level at which a decision on adoption can be made. Therefore, it is necessary to understand possible knowledge gain and adoption of a new technology together with associated factors, and take corrective measures, for example, take more positive steps for mass media exposure for increasing awareness and remove supply constraints to facilitate rapid adoption.

### **The Study Location and Methods**

Empirical studies on agricultural knowledge adoption generally, divide a population into adopters and non-adopters, and analyse reasons for adoption or non-adoption. In reality, knowledge adoption is not a one-off static decision, rather, it involves a dynamic process in which knowledge gain and experience play pivotal roles. In this view, data were collected from farm women in Sengerema and Kilosa districts located in Mwanza and Morogoro Regions, respectively. Selection of the study districts was guided by specific features related to availability and accessibility of telecentres that train as well as disseminate agricultural knowledge to farmers in rural settings. The study areas also have high level of agricultural development that necessitated the need to link the fastest growing ICTs sector in Tanzania with one of the most important economic sectors (agriculture). The rationale was to fill the gap between what ICTs can offer and the reality of how these technologies have actually been used to empower farm women.

To achieve the intended specific objectives, therefore, the study employed a cross-sectional research design with specific attention on survey method to individual farm women using structured questionnaires that were self-administered to respondents in the study areas. As such, a grand total of 180 farm women users of the telecentres' services were randomly and equally selected using simple random sampling in the study districts (Sengerema and Kilosa). Simple random sampling is a probability sampling procedure where every unit in the population of farm women users of the telecentre had an equal chance and the likelihood of being selected using the random list of assigned numbers from the telecentre managers. This is because simple random sampling procedure enhanced chances of getting samples representing characteristics of a farm women at the telecentres. Therefore, a total of 90 farm women were randomly selected from Sengerema District around the telecentre, namely, "Sengerema Multi-purpose Community Telecentre (SMCT)" alongside with "Community Radio-Sengerema" (Plate 1). Likewise, a total of 90 farm women were randomly selected from Kilosa District around the telecentre, namely, "Kilosa Rural Services and Electronic Communication (KIRSEC)" for study inclusion (Plate 2).



Plate 1: "Sengerema Multi-purpose Community Telecentre (SMCT) alongside with Community Radio" in Sengerema District, The biggest public owned telecentre in Tanzania. (ELEV: 3914ft S02°38.998' E032°38.627')



Plate 2: "Kilosa Rural Services and Electronic Communication (KIRSEC)" in Kilosa District, privately owned.

(ELEV: 1585ft S06049.766' E036059.228')

The random list of respondents was gathered from the telecentres, where farm women were organized in self-help groups (SHGs) and they are using user-friendly Interactive Multimedia Compact Disc (IMCD) through Liquid Crystal Display (LCD)-projector (with interaction) as a group learning tool. The IMCD is one of the most versatile

audio-visual media of communication in the two telecentres. According to the two telecentres, IMCD through LCD projection and interaction is very efficient, accurate, quick and somewhat cheaper for disseminating agricultural technologies from research system to the farm women. Therefore, IMCD through LCD projection (with interaction) helps the telecentres to disseminate computer-based interactive communications process that incorporates text, graphics, sound, animation/illustrations, and video. The agricultural information dissemination system at the telecentres is interactive because the telecentres determine about important content to be delivered, participants, time it is delivered and the manner it is delivered.

Therefore, during the study, farm women's socio-economic characteristics were identified and studied to ascertain their relationship including influence on the dependent variables (knowledge gain and adoption). The socio-economic characteristics imperative to the study included age, education status, occupation status, farm status, farming experience, annual income, mass media exposure, computer training undergone, computer utilization behaviour, innovativeness, awareness about agricultural IMCD, and perceived effectiveness of agricultural IMCD. To understand the association between the selected characteristics of the farm women and their knowledge gain as well as adoption, simple correlation was computed. Likewise, influence of the selected variables on knowledge gain and adoption were computed using multiple regression analysis.

#### **Farm women's utilization behaviour of interactive multimedia compact disc (IMCD)**

Knowledge is the crucial component that plays a vital role in the behaviour of an individual farm woman. Dissemination of knowledge or scientific information among farm women plays a greater role in adoption of that particular knowledge. Keeping this in view, Table 1 provides distribution of farm women according to their utilization of Interactive Multimedia Compact Disc (IMCD) through LCD projection when visiting the telecentres. Results showed that about 77.8 percent of the farm women in the self-help groups (SHGs) had not utilized agricultural user-friendly Interactive Multimedia Compact Disc through LCD projector and the interaction for the betterment of farming activities (Table 1). The remaining 22.2 percent of the farm women utilized the agricultural user-friendly Interactive Multimedia Compact Disc (IMCD) through LCD projector and the interaction.

The inference drawn from presented responses in Table 1, indicates that 72.5 percent of farm women in SHGs utilized the agricultural user-friendly IMCD through LCD projection (with interaction) at the telecentres for agricultural purpose. An attempt was made to assess the farmers' opinions regarding utility of IMCD as a tool used for transfer of farm technologies. According to the survey (Table 1), among the utility value of IMCD through LCD projector and the interaction to the farm women in SHGs, they were mainly for computer literacy (100%), to learn skills (access to market information services), for example, market prices, new markets (100%), and access to

weather information services (20%). Inferences from results support what Ibrahim and colleagues (2010) as well as Morton and Kerven (2013:3) who reported that farmers considered ICT services offered by the telecentre to be extremely important for market information, weather forecasts services, and other daily farming activities in rural areas.

**Table 1: Distribution of respondents according to their utilization behaviour of interactive multimedia compact disc through ICD projection at the telecentres**

Variable Category	Count	Per cent
<b>Interactive Multimedia Compact Disc (N=180)*</b>		
Not utilized	140	77.8%
Utilized	40	22.2%
<b>Purpose of Use (n=40)*</b>		
Agriculture	29	72.5%
Non-Agricultural activities	11	27.5%
<b>Utility value of IMCD through LCD projection (with interaction) (n=40)*</b>		
Computer literacy (teach illiterate farmers)	40	100.0%
To learn skills, e.g., market prices, new markets	40	100.0%
Access to weather information services	8	20.0%
<b>Frequency of Use (n=40)*</b>		
Daily	0	0.0%
Once in two days	9	22.5%
Once in a week	31	77.5%
<b>Message Storability (n=40)*</b>		
Hard disc (computer itself)	25	62.5%
Hard copies (print out)	11	27.6%
CD	4	10.0%

\*Data sets were based on multiple responses

Table 1 indicates that among IMCD services users, about two-fifth (77.5%) of the farm women in the self-help groups (SHGs) were found to use the facilities at the telecentres once in a week followed by 22.5 percent alluded to use once in two days and none of them used them daily. It could be inferred that the farm women applied the user-friendly IMCD service facilities mainly to obtain information on market related and weather forecasts and thus, they may have been the reason for browsing once in a week and once in two days. As seen in Table 1, a bit over two-thirds (62.5%) of the farm women in SHGs were saving or storing information pertaining to agricultural knowledge information in hard disc (computer itself) followed by 27.6 percent as hard copies (print outs) and the remaining (10.0%) stored in compact discs. Information such as market prices, correspondence and important documents were taken as printouts.

**Relationship of Socio-economic Characteristics towards Knowledge Gain and Adoption**

In order to understand association between the selected characteristics of farm women in SHGs, their knowledge gain, and knowledge adoption on agricultural user-friendly IMCD and internet facilities at the telecentres, simple correlation was computed as presented in Table 2.

**Table 2: Relationship of Socio-economic Characteristics towards Knowledge Gain and Adoption (N=180)**

Variable No.	Variables	Knowledge Gain	Knowledge Adoption
		"r" value	"r" value
X <sub>1</sub>	Age	-0.434**	-0.120 NS
X <sub>2</sub>	Education Status	0.577**	0.217 NS
X <sub>3</sub>	Occupation status	-0.068 NS	0.217 NS
X <sub>4</sub>	Farm status	-0.428**	0.522**
X <sub>5</sub>	Farming experience	-0.147 NS	-0.472**
X <sub>6</sub>	Annual income	-0.217 NS	-0.187 NS
X <sub>7</sub>	Mass media exposure	0.572**	0.221 NS
X <sub>8</sub>	Computer training undergone	0.184 NS	-0.276 NS
X <sub>9</sub>	Computer utilization behavior	-0.076 NS	-0.216 NS
X <sub>10</sub>	Innovativeness	0.086 NS	0.452**
X <sub>11</sub>	Awareness about agricultural IMCD	0.185 NS	-0.124 NS
X <sub>12</sub>	Effectiveness of agricultural IMCD	-0.016 NS	0.127 NS

NS – Non-Significant; \*\* Significant at 0.01 level of probability; \*Significant at 0.05 level of probability

**Relationship of socioeconomic characteristics towards knowledge gain**

It is observed from Table 2 that out of twelve characteristics studied, two characters were found to be having a positive association with knowledge gain. The characters, namely, education status and mass media exposure were found to be positively associated with knowledge gain at 1 percent level of probability. Age and farm status were found to have a negative association with knowledge gain at 1 percent level of probability. The other variables farming experience, occupation status, annual income, computer training undergone, computer utilization pattern, innovativeness as well as awareness and perceived effectiveness of agricultural IMCD were found to have no association with knowledge gain. It is an accepted fact that higher education and mass media exposure of the respondents might have helped to get more knowledge gain. The variables age and farm size had negative association with knowledge gain. The increase in age might have led to less learning capacity of the farm women in SHGs. A similar trend of increased farm size would have decreased the knowledge

gain. These findings are in accordance with results from the study by Senthil (2018) who reported that farmers' media exposure to agricultural information possess a positive and significant relationship with their knowledge gain.

### **Relationship of Socio-economic Characteristics towards Knowledge Adoption**

Results of correlation analysis of socio-economic characteristics on knowledge adoption as presented in Table 2 could be explicit that out of studied twelve characteristics, only two characteristics were found to have a positive association with knowledge adoption of technologies recommended in the IMCD. The characteristics, namely, farm status and innovativeness were found to be positively associated with knowledge adoption at 1 percent probability level, whereas farming experience was found to have a negative association with knowledge adoption.

The remaining variables age, education status, occupation, annual income, mass media exposure, computer training undergone, computer utilization behaviour, awareness and perceived effectiveness of agricultural IMCD were found to have a non-significant association with knowledge adoption. Larger farm size and more acreage under cultivation might have increased knowledge adoption level in order to try new technologies in their farms.

With more farm women's innovativeness, greater would be knowledge adoption of technologies recommended in the agricultural user-friendly IMCD. That may be due to the probable reason of interest in getting additional yields and more returns from the farming. Furthermore, innovators are always ready to accept any new technologies. Adoption of technologies for sustainable farming systems is a challenging and dynamic issue for farmers, extension services, agri-business and policy-makers. Demand is driving adoption of technologies. Farmers have always looked to new technologies as a way to reduce costs. These could be possible reasons for having a positive relation.

Higher experience level in farming would have decreased knowledge adoption due to rich experience in farm maintenance. This finding makes it clear that people who had rich experience in farming were exposed to mass media and other sources of information such as extension personnel to gain knowledge about recent technologies. According to John and Johnny (2014: 668), farming experience is useful in early stages of adoption of a given technology when farmers are still testing its potential benefits, which later on, determine its retention or dis-adoption over time. Thus, gradual advances in technology development and continuous retraining of farmers are essential for sustainable adoption of agricultural technologies for some crops. Furthermore, according to Knowler and Bradshaw (2007: 29), whether farming experience enhances or discourages agricultural technology adoption remains unclear in existing studies. However, definite answers are essential for policy-makers, especially those promoting adoption of agricultural technologies and participation in field farmer schools (Duveskog *et al.*, 2011: 1533). Field farmer schools have evolved

through experiential education for farmers (Feder *et al.*, 2004: 54; Aldana *et al.*, 2011: 135; Okafor and Okwuchukwu, 2015: 9). As farmers accumulate experience over time, they progressively switch from traditional agricultural technologies to improved technologies on the basis of observed performance and learning by doing (John and Johnny, 2014). Learning by doing depends on release of new agricultural technologies. Furthermore, if researchers fail to keep developing superior technologies, these technologies are unlikely to achieve significant progressive adoption (Anderson and Tushman, 1990: 608; Yamazaki and Resosudarmo, 2008: 137; Smaranika, 2010).

**Influence of Socio-economic Characteristics on Knowledge Gain and Adoption**

Agricultural knowledge gain and adopting a decision regarding improvement of practices is usually influenced by various factors including farmers’ socio-economic attributes. Therefore, multiple regression analysis was carried out and results are presented in Table 3 to examine socio-economic factors influencing on knowledge gain and adoption among farm women.

**Table 3: Influence of Independent Variables on Knowledge Gain and Adoption**

Variable No.	Variables	Knowledge Gain	Knowledge Adoption
		“t” value	“t” value
X <sub>1</sub>	Age	-2.681**	0.162 NS
X <sub>2</sub>	Education Status	2.786**	0.176 NS
X <sub>3</sub>	Occupation status	0.087 NS	0.390 NS
X <sub>4</sub>	Farm status	-1.982*	2.665**
X <sub>5</sub>	Farming experience	0.812 NS	0.610 NS
X <sub>6</sub>	Annual income	-0.086 NS	-1.471 NS
X <sub>7</sub>	Mass media exposure	3.498**	-2.812**
X <sub>8</sub>	Computer training undergone	0.525 NS	1.420 NS
X <sub>9</sub>	Computer utilization behavior	-0.086 NS	-1.781 NS
X <sub>10</sub>	Innovativeness	0.628 NS	3.217**
X <sub>11</sub>	Awareness about agricultural IMCD	-1.567 NS	-0.056 NS
X <sub>12</sub>	Perceived effectiveness of IMCD	-0.087 NS	-0.467 NS

*R*<sup>2</sup> = 0.6127 (knowledge gain); *R*<sup>2</sup> = 0.4012 (knowledge adoption); NS – Non-Significant

\*\* Significant at 0.01 level of probability; \* Significant at 0.05 level of probability

**Influence of the Socioeconomic Characteristics towards Knowledge Gain**

From Table 3, it could be seen that the coefficient of multiple determination *R*<sup>2</sup> was 0.6127, which was significant at 1 percent level. This means that 61.27 percent of variation in the dependent variable is explained by the independent variables chosen for the study. The partial regression coefficient value was found to be negatively

significant for variable, age at 1 percent significance level and the farm status behaviour at 0.05 percent significance level (Table 3). This revealed that a unit increase in age would decrease knowledge gain by 2.68 units *ceteris paribus* (with other variables/conditions remaining the same/constant/equal/ unchanged).

Farm status had negative coefficient, which means that a unit increase in farm status, *ceteris paribus*, would result in decrease in knowledge gain by 1.98 units. The variables education status and mass media exposure influenced positively and significantly on knowledge gain. This showed that a unit increase in educational status and mass media participation, *ceteris paribus* would increase gain in knowledge by 2.79 and 3.50 units, respectively.

### **Influence of Socio-economic Characteristics on Knowledge Adoption**

The multiple regression analysis was carried out to assess extent of influence of twelve socio-economic characteristics on knowledge adoption. From Table 3, it could be observed that coefficient of multiple determination  $R^2$  was 0.4012, which was significant at 1 percent level. This meant that 40.12 percent of the variation in dependent variable is explained by independent variables selected for the study.

Results vividly show that farm status and innovativeness had contributed positively at 1 percent significance level towards knowledge adoption, whereas mass media exposure contributed negatively at 1 percent significance level. A unit increase in farm status and innovativeness, *ceteris paribus*, would result in increasing knowledge adoption to an extent at 2.67 units and 3.22 units, respectively. This finding is in agreement with findings by Baumüller (2017) who conducted research on agricultural web page users and reported that innovation on the web page is positively contributed towards knowledge gain.

### **Problems in utilizing user-friendly Interactive Multimedia Compact Disc (IMCD) Technology at the Telecentres**

It was deemed necessary to study constraints faced by farm women in utilizing the IMCD technology at the telecentres. Constraint analysis helps the planners, administrators, development workers, scientists and others to frame policies and to implement schemes. This is because as the traditional agriculture is transforming, the need for updated and reliable information is also essential for agricultural production as well as productivity and eventually, giving a lucrative yield and income to the farming community. This is due to the fact that improved communication and information access are directly related to socio-economic development. Access to information and improved communication is a crucial requirement for sustainable agricultural development. However, it is observed that the rural population still has difficulty in accessing crucial information in order to make timely decisions on productivity. Therefore, constraints faced by farm women in utilizing user-friendly interactive multimedia compact disc (IMCD) technology at the telecentres were

studied. The multiple responses that provided data sets of constraints were worked out during the study. The results are presented in Table 4.

**Table 4: Problems Expressed by Farmers in Utilizing User-friendly Interactive Multimedia Compact Disc (IMCD) Technology at the Telecentres (N=180)**

S/No.	Problems	Number*	Percentage (%)
1	Lack of information in local language	180	100.00
2	High cost for ICTs services	172	95.55
3	Not suitable to illiterate people	169	93.88
4	Difficulty in handling computer	165	91.66
5	Lack of appropriate locally origin contents	160	88.88
6	Regular power/ electricity-cut	157	87.22
7	Lack of skills to use modern information technology gadgets	142	78.88
8	Lack of familiarity towards modern information technology gadgets	140	77.77
9	Lack of relevant information in other IMCD	132	73.33
10	Lack of prompt reply to their farming queries and clarifications	97	53.88
11	Lack of update information	90	50.00
12	Difficulty in reading computer information	82	45.55
13	Inability to internalize computer information	75	41.66
14	Difficulty in reading online information	62	34.44

\* Data sets are based on Multiple Responses

The major problem as expressed by all (100%) respondents was lack of information in local language due to the fact that most of the information in IMCD is published in either in technical Kiswahili or English languages; high cost for ICTs services (95.55%); unsuitable to illiterate people (93.88%); difficulty in handling computer (91.66%); and lack of practice and proper training on computer use of together with its accessories. Others include lack of appropriate locally original contents (88.88%); regular power-/electricity-cut (87.22%); lack of skills to use modern information technology gadgets (78.88%) as most of the farm women lacked training on the use of modern gadgets; lack of familiarity towards modern information technology gadgets (77.77%); and lack of relevant information (73.33%). Further factors included lack of prompt reply to their farming queries as well as clarifications (53.88%); lack of update information (50.00%); difficulty in reading computer information (45.55%); inability

to internalize computer information (41.66%); and few percent of the farm women expressed that they had difficulty in reading online information.

### **Suggestions for Effective Utilization of user-friendly Interactive Multimedia Compact Disc (IMCD) Technology at the Telecentres**

It was deemed important to get suggestions for creating access and promotion of any technology among target farming communities. This has important implication for possible formulation of appropriate strategies and blueprint for the technology. The suggestions by the farm women for effective utilization of IMCD technology were studied. The results are presented in Table 5.

**Table 5: Suggestions for Effective Utilization of user-friendly Interactive Multimedia Compact Disc (IMCD) Technology at the Telecentres (N=180)**

S/No.	Suggestions	Number*	Percentage (%)
1	Information may be in local language	180	100.00
2	Location specific information may be provided	172	95.55
3	Training may be provided to learn computer in detail	170	94.44
4	Regular update of the IMCD information	167	92.77
5	Enhance locally origin contents	160	88.88
6	Stable power/electricity be provided	157	87.22
7	Telecentres may be providing location specific weather data	152	84.44
8	Linking telecentres with local agricultural institutions	149	82.77
9	On line marketing facilities for farm produce	137	76.11
10	Keeping recent agricultural information at the telecentres	102	56.66
11	Self-Help Groups to be institutionalized in the government systems	91	50.55
12	More number of telecentres	71	39.44
13	Linking local extension service providers with telecentres	51	28.33

\* Data sets are based on Multiple Responses

Suggestions by the farm women are presented in Table 5. Major suggestions were giving information in local language expressed by all (100%) farm women for easy comprehension by all farmers; followed by location specific information (95.55%) to reach all farmers who are spread across the country with diversified climatic conditions; training to operate computers (94.44%) due to digital divide among rural farmers on usage of computer; and regular update of the IMCD information (92.77%) to fulfil the latest as well as current agricultural information need to farmers. Others included to enhance locally origin contents (88.88%); stable power/electricity should be provided (87.22%); telecentres may be provided location specific weather data

(84.44%); linking telecentres with local agricultural institutions (82.77%); on line marketing facilities for farm produce (76.11%); keeping recent agricultural information at the telecentres (56.66%); Self-Help Groups to be institutionalized in the government systems (50.55%); create additional telecentres (39.44%); and few women suggested on linking local extension service providers with the telecentres' services for effective update as well as utilization of IMCD information in rural settings.

### **Conclusion**

This paper assessed the scope for utilizing information communication technologies (ICTs) for spread of new agricultural knowledge and its adoption. This is because currently, the conventional extension system has been facing several challenges in delivering information to farmers. Moreover, farmers need encompasses much more diversified knowledge and more knowledge gain driven and thus, to address them is beyond the level of grass root extension functionaries. Likewise, use of ICTs in agriculture, in particular, remains restricted to Tanzania. However, effective utilization of ICTs has the potential to improve the livelihoods of the rural communities in Tanzania. For ICTs initiatives to be successful and sustainable in the long run, collaborative efforts are indispensable. Among constraints in use of ICTs, specifically the IMCD such as lack of content in local language and high cost for ICTs services, among others, require collaborative efforts, clear policies and vision at national level. This is because agricultural knowledge gains as well as adoption are basic ingredients of food security and they are essential for facilitating rural development and bring about socio-economic transformation.

Nowadays, it is possible to deliver information timely by computer-based technologies and Information communication Technologies (ICTs), which are interlinked among extension, research, marketing network and farm communities to provide information. Therefore, the current study revealed that cyber extension (use of ICTs for agricultural and rural extension), through use of telecentres should be promoted and skilled trainers should be given proper and regular trainings in rural areas of Tanzania. During the study, it was further depicted that majority of the farm women in self-help groups (SHGs) were unaware of user-friendly Interactive Multimedia Compact Disc (IMCD) at the telecentres, despite the fact that they are more interested to know about it for their farming activities. This shows that large scale awareness campaigns and local mass media through community radio broadcasts can be utilized to promote user-friendly Interactive Multimedia Compact Disc (IMCD) technology for agricultural information dissemination.

The findings also revealed that farm women were satisfied with the services provided at the telecentre and voiced their suggestions for improving the technology. This suggests that the scientific community should take initiatives to evolve technologies, which would compromise farmers in terms of affordability and effectiveness. These findings underscore cyber extension as a useful mechanism to facilitate dissemination of agricultural and rural extension.

Utilization behaviour level of the Interactive Multimedia Compact Disc (IMCD) was found to be low and this indicated that there is an urgent need for development as well as popularization of such technologies to farmers. The variables such as educational status, mass media exposure, innovativeness, farm status and farming experience were found to act as critical variables. Therefore, while preparing the Interactive Multimedia Compact Disc (IMCD) in future, one should take care of these variables. That is to say, ICTs content development should take into account the educational status, mass media exposure, innovativeness, farm status and farming experience so that these technologies are tailor made and are context specific. Moreover, ICTs policy interventions with clear vision at national level should facilitate telecentre owners and entrepreneurs with the task of opening agricultural information centres on partnership with farmers' associations to teach as well as train farm women in accessing and using new ICTs in rural areas for agricultural knowledge gain together with adoption.

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