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DETERMINANTS OF ADOPTION OF DAIRY FARMING TECHNOLOGIES BY RURAL WOMEN IN KHWISERO, KAKAMEGACOUNTY

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Abstract

There is no doubt that adoption of dairy farming technologies is absolutely vital for the growth of the dairy industry. This is because dairy farming technologies have several benefits namely, excellent reproduction potential, faster growth rate and higher yields for both dairy animals and fodders, and improvement of household welfare. However, the adoption of such technologies by rural women in Sub Sahara Africa is still low. Dairy farming technologies adoption is a multidimensional process driven by capacities distributed through technologies characteristics and society. The study from which the article is written was conducted in Khwisero sub-county, Kakamega County in Kenya in 2017 with an aim to establish the determinants of the adoption of dairy technologies in the location of study. Random sampling was used to sample location and sub-location and to select 72 respondents from the target of 720. The study identified several determinants of adoption of dairy technologies. These included cultural values and norms (27%),cost and dairy farming technologies characteristics (22%), level of involvement in decision making (18%),fear of unforeseen risks and uncertainties (14%) level of formal education (11%) and resistance to change(4%). Therefore, the study recommended that implementers take affirmative action and ensure direct participation of women and men in dissemination of technologies.. In addition, dairy development agencies oughttouse multi-sectorial and multifaceted approaches in order to minimize constraints in adoption of dairy farming technologies among rural women in study area.

Keywords: Dairy farming technologies, Rural women dairy farmers, determinants the adoption of dairy technologies, Growth of dairy industry.

Introduction

There is no doubt that adoption of dairy farming technologies is absolutely vital to

the growth of the dairy industry. Rural women, being key players in dairy farming, need to adopt available dairy technologies in order to reap maximum benefits from this huge and growing industry. Abel, Osoro and Getabu (2015) observed that dairy farming technologies had several benefits namely, excellent reproduction potential, faster growth rate and higher yields for both dairy animals and fodders, and improvement of household welfare. However, they stated that adoption of such technologies by rural women in Sub Sahara Africa was still low. In addition, King (2006) found that milk production in Africa had not kept pace with the growing population and added that there still existed significant levels of traditional dairy production. This might be an implication of inequality in adoption and use of dairy technologies that was yet to be explicitly identified, recognised and integrated into awareness creation. Accordingly, Chikagwa and Weideman (2010) suggested that dairy farming technologies adoption by rural women in Africa was instrumental in increased productivity and household income. They, however, added that this adoption was slow- paced and low, a phenomenon adversely affecting rural women households practicing subsistence dairy farming.

A United Nations report (1990), cited by Sulo et al. (2012), indicated that rural women were farmers, livestock managers, workers and entrepreneurs within the sector. However, the level and quality of their participation did not result in sustainable socio-economic development benefits. This was also observed by Anouka,Van Eerdewijk and Danielsen, (2015) who found that rural women often achieved lower yields in dairy farming than men; which was attributed to women's low demand for and articulation of dairy technologies. Needless to say, there were widespread gender gaps, informalities and disparities hindering the rural women from adopting dairy farming technologies inAfrica.

A report by the Kenya Dairy Board (2014) estimated that 80% of the milk produced in rural areas was dominated by rural women subsistence farmers. The report further disclosed stagnation in dairy farming across agro-regional zones characterized by uneven adoption of dairy farming technologies. The report also indicated that this stagnation was occasioned by the persistent use of traditional practices among rural women in their households.

Another study by Muriuki et al. (2003) established that rural women in Kenya were the main actors in the daily activities of dairy farming including cutting and carrying fodder, feeding cows, and fetching water. The report noted, however, that their passion to adopt dairy farming technologies in their households was less robust. In his study Karanja (2003) established that 80% of the milk produced in Kenya came from UasinGishu and Kiambu

Counties. He found that this was due to increased adoption of dairy farming technologies by rural women at the household level. This was also confirmed by a later study by Gitonga (2014) who stated that most women households in Githunguri area of Kiambu County had adopted exotic cow breeds, established fodder and embraced fodder conservation methods. He further noted that rural women in Nyandarua and UasinGishu counties had positively adopted dairy farming technologies. As a result, there were indications of increased milk production per cow and more women economic empowerment through minidairies. Additionally, Gitonga (2014) observed that those counties had increased numbers of milk collection centres, milk bars and processing factories; which created jobs for youth and established support businesses in feeds and agro -veterinary supplies.

DETERMINANTS OF ADOPTION OF DAIRY FARMING TECHNOLOGIES AMONG RURALWOMEN

According to Kenya Population Housing Census report for (2009), Kakamega County had a population of over 1,660,651 women and men, people who mainly depended on agriculture (sugarcane, dairy farming, and tea) for a livelihood. Approximately 80% of the population was classified as poor subsistence farmers, made up of mainly women farmers. According to the Kakamega County Government Profile (2013) due to cultural traditions of land sub-division, the land holding has on average been reduced to below 2.5 acres per household. As a result of these pressures, households had discarded agricultural activities requiring large tracks of land. Consequently, farmers required farm enterprises that not only increased their household incomes but also required less resource inputs. Dairy farming technologies was one such enterprise that if adopted, had the potential of lifting households' welfare and food security in the county (Kakamega County Government Profile, 2013). An understanding therefore of the determinants of adoption of dairy farming technologies was essential in planning and executing technology related programmes and meeting challenges in dairy industry.

Categorization of Determinants of Dairy Farming Technologies Adoption

Dairy farming technologies adoption is a multidimensional process driven by capacities distributed through technologies characteristics and society. Consequently, the literature on dairy technologies adoption is enormous and somewhat difficult to summarize. Conventionally, the analysis of dairy farming technologies adoption focus is on imperfect

information, risk, uncertainty, institutional constraints, human capital, input availability, and infrastructure as potential explanations for adoption decisions.

A study in Ghana by Akudugu et al. (2012) on adoption of modern agricultural technologies by farm household classified the determinants of adoption of technologies into three categories, namely, economic, social and institutional. On other hand, Obayelu et al. (2017) study in Nigeria on determinants of adoption of agricultural technologies by smallholder farmers categorized the determinants into: traditional, social, economic and physical. Doss (2003) conducted a study in East Africa on understanding farm level technologies adoption categorized the factors into: farmer characteristics, farm structure, institutional characteristics and managerial structure.

According to Samuel et al.(2016) in a study conducted in Southern Ethiopia on adoption and impact of dairy production technologies classified determinants to adoption into informational, economic, infrastructure and ecological, while Muchangi (2016); Gitonga (2014);Makokha et al. (2007) classified the determinants into human capital, production, market availability, policy and natural resource characteristics.

Grouping determinants may not be representative on it is effect on women. Generally, the scholars' focus on determinants of adoption was based on technology characteristics, economics, human capital finance, infrastructure, farm and institutional structures. However, decisions on adoption of dairy farming technologies interplay with gender dynamics within a household to determine the implementation. These dynamics do comprise power relations; resource ownership, access and equity in allocation of activities while influencing the decisions and priorities of the users of rural farm resources. It is therefore essential to assess the needs and priorities of every individual member in a household in determining their adoption level to the dairy farming technologies. This will be helpful for both implementers and rural women in setting priorities towards adoption, and sustainable use of dairy farming technologies in production.

Determinants in Adoption of Dairy Farming Technologies by Rural Women

There are many identified hindrances to the uptake of dairy farming technologies. These hindrances tend to vary across different genders. Literature examination shows that a farmer's gender affects their rate of adoption of dairy farming technologies. Studies by Makokha (2005) and Nabiswa et al. (2016) in Kenya, established that certain factors such as increasing young population pressure on land, a sagging sugarcane industry, need to

strengthen the household income and nutrition drove the National Dairy Development Programme (NDDP), County government dairy initiative and NGOs to implement the dairy farming technologies programme.

Obayelu et al. (2017) established social-cultural practices as a hindrance to dairy farming technologies adoption by rural women. They found that culture played a role in containing adoption through rural women socialization, peer effects and norm- based diffusions. Social and cultural perspectives might diminish the role of women, deny their individual needs and ways of meeting those needs, and so acted as push factors against adoption. Lack of rural women's needs assessment, inclusion during programme designs, and opportunities to raise their voice during implementation of technologies can constraint the uptake of these technologies. Moreover, an evaluation of the role of training and methods of training used do influence rural women's behaviour change. This could enable innovators to put in the needs of rural women in all processes of design to implementation of dairy farming technologies.

The awareness of available dairy technologies as carried out through existing rural women social groups is another determinant. The introduction of dairy farming technology through women groups was an expeditious move to replicate in most rural households of Kakamega County (Musalia et al. 2007). However, studies by Nalunkuuma et al. (2013) revealed Kakamega County as having continuously registered low growth in the dairy industry. This may indicate that the awareness of dairy farming technologies was not aggressively done through existing women group networks.

FAO (2011) argues that training is key to the adaptation of dairy technologies. Adequate training goes a long way in increasing the rate of adoption. On the other hand, inadequate training of rural women dairy farmers acted as a hindrance to adoption of technologies. It is important to acknowledge that the success of training was a dependent on the expertise of the trainer, preferences of the women trained; paired with level of exposure and gender of trainer. In addition, the training methodology used and the level of experience of both the trainer and trainee with other technologies could also act as constraints to adoption.

A study by Ageya et al. (2016) in UasinGishu County, Kenya, on gender participation and commercialization of smallholder dairy farming also established that rural women lack of access to and minimal control over benefits from dairy technology were a constraint to

adoption of dairy farming technologies. On the other hand, Anounka et al. (2015) found that risk of men capturing control over resources and benefits from technology adversely affect adoption. Their study also proved that men typically moved into women's activities once they become profitable. This may imply that the implementers of dairy technologies did not exhaustively understand the perceptions, benefits and challenges of the technologies they pushed for adoption.

STATEMENT OF THE PROBLEM

Dairy technologies have many benefits. There is no doubt that their adoption is absolutely vital to the growth of the dairy industry. Rural women, being key players in dairy farming, need to adopt available dairy technologies in order to reap maximum benefits from this huge and growing industry. The adoption of these technologies however, appears to be low. There seems too to be there many determinants to the adoption of dairy technology which if not well understood undermine the adoption. It is therefore important to define the determinants if the adoption of dairy technologies shall be increased.

OBJECTIVES

The general objective of the study was to detemine the adoption of dairy farming technologies by rural women in Khwisero, Kakamega County. The specific objective on which this article is hitched was to find out the determinants of adoption of dairy farming technologies by rural women in Khwisero, Kakamega County.

SIGNIFICANCE OF THE STUDY

Despite the many known benefits of dairy technologies, their adoption by rural women dairy farmers in Khwisero, in Kakamega County remains very low. This may be the reason behind the low dairy production in the area. In a bid to increase the adoption rate, it is important to establish the determinants; which the stakeholders in the industry seem largely unaware of.

METHODOLOGY

The study from which the article is written employed a descriptive survey research design to collect both qualitative and quantitative data from Khwisero sub-county, Kakamega County in Kenya. The study aimed to establish the determinants of the adoption of dairy technologies in the location of study. The target population for the study comprised all

women who were dairy farmers in the cooperative group in Kwisero. Random sampling was used to sample location and sub-location and to select 72 respondents from the target of 720. The study used different instruments to collect both primary and secondary data. These included questionnaires, key informant interview guides, focus group discussions guides and an observation checklist.

RESULTS AND ANALYSIS

Table 1: Determinants of Adoption of Dairy Farming Technologies

Determinants of Adoption of dairy farming technologies	**Frequency**	**Percentage**
Level of formal education	5	11
Level of involvement in decision making	8	18
Cultural values and norms	12	27
Cost and Dairy farming technologies characteristics	10	22
Unforeseen risks and uncertainties	6	14
Resistance to change to new technologies	2	4
No response	2	4
Total	**45**	**100**

Table 1 indicates a mixture of determinants that affected rural women dairy farming technologies adoption. The results show that 27% of respondents in Khwisero reported cultural values and norms as a determinant to adoption while 22% observed cost and dairy farming technologies characteristics. The level of involvement in decision making (18%) and unforeseen risk (13%) of technologies was also indicated as a determinant in adoption by respondents. The other determinants thus Level of education and resistance to change to new technologies were 11% and 4.4% respectively.

Cultural Values and Norms

Cultural values and norms (26.7%) determined adoption of dairy farming technologies. A further finding from key informants revealed that culture played an important role through rural women socialization, peer effects and norm-based flow of information; affecting how adoption took place. Key informant further observed that cultural norms had effect on information processing capability hence technology's awareness messages perceived as complex and competitive to traditional practices. This, in turn affected

the rate of diffusion of technologies as explained by keyin formant. A key informant also held that there was interplay between culture and rights to land ownership. An example was given on land rights being accorded only to male spouses and upon their death the same were passed on to sons. Additionally, there were elaborate conflicts in resource allocation in polygamous families in the study area. Further, the sharing of land among cowives made them unresponsive to the adoption of dairy farming technologies. It can be deduced that land ownership and activities allocation is taken as the role of men. As such, women might not greatly take advantage of the wide range of dairy farming technologies associated with ownership and control of land.

The key informant observed that rural women's ignorance of their rights to land and lack of dissemination of the legislation to the grassroot levels made women to lag behind in resource ownership in comparison to other Counties. It is apparent in study area that men enjoyed rights of land ownership at the expense of their women counterparts. Further, their rights were influenced by cultural values and norms through socialization on gender roles. On the same note, the key informant held that implementers focused more on technical application of technologies rather than considering the gender perspective on resource allocation for technology uptake. The key informant concluded that there was need to consider the role played by rural women and repackage the information to include land and it is allocation to specific dairy farming technologies. In addition, the informant called for inclusion of stakeholders, for instance, Ministry of lands in the sensitization on land policies regarding women and men ownership. This, as a path to increasing rural women's access to land and properties right, remove gender disparities in resource ownership, and promote adoption.

Another key informant also stated that men had full ownership of family property and intimated that immediately a dairy farming technology entered a homestead, it became the property of household head; that is to the man of the house. Additionally, lack of property ownership placed rural women at a lower level of advantage in areas of security of home and in adoption of dairy farming technologies. Consequently, awareness on existing land laws and sufficiency in legal redress should be taken as one step in the effort to increase rural women access to resources and in adoption as reported by the key informant.

Land ownership is a key factor in dairy farming technologies adoption. Dairy farming technologies require space, time and labour in order to derive the benefit. In view of land ownership as reported by key informants, greatly affected rural women more than men, yet they were the target in implementation of dairy farming technologies. This might also be the

reason to dairy farming technologies adoption tends to be higher in groups than at the household level. Accordingly, technologies implementers should take into account the gender dynamics in resource put and it is significance in adoption of technologies as one way to reduce land ownership barriers and accelerate adoption by rural women.

Further interviews with key informant, pointed out that women had been socialized to respect and depend on men, denying them autonomy. This was with an exception of few economically empowered married or single women. The key informant was quick to single out the fact that women with autonomy were labeled in the society as rebels. It made them be stigmatized and detached from adoption of dairy farming technologies. This means that women irrespective of a level of empowerment would often be sidelined in making decisions on dairy farming technologies adoption. Key informant called for implementers to look into unforeseen gender biases in terms of technologies' application, labour requirements and accessibility. This would mean granting women independent autonomy of choice and selection of dairy farming technologies.

On another point, a key informant, disclosed lack of in-service training on gender roles and their applicability in trainings to extension officers as a long standing constraint on adoption of dairy technologies in the study area. When the sentiment was posed during interview with another key informant, it was established that most rural women were driven by customary law of patriarchy and gender roles tending to favour men than women. In addition, traditional structures denied women representation in village land and asset ownership committees which acted as scare to women in adoption. From the findings, gender differences in roles, rights of resource ownership, and lack of inclusion of information on gender roles in awareness determined the rate of adoption of dairy farming technologies by rural women in study area.

During FGDs, one respondent narrated thus:

"Implementers of dairy farming technologies follow traditional socialisation where more farm work activities are assigned to women than men. Men attend most workshops as women are left to carry out fodder establishment in the model farms and feed cows" (FGDs Mundaha)

From the sentiment, socially constructed norms had been embraced by implementers to believe women are active farm workers while men were upheld as seekers of information. This might as well be one cause of low status in adoption that can be attributed to lack of

exposure to outside realities. It was also learnt from FGDs that social cultural perspectives diminished the role of women, denied their individual needs and ways of meeting those needs; hence acted as push factors agains tadoption.

In another FGD in Munjiti, a respondent expressed concern that:

> "*Certain taboos do not allow adoption of technologies. For example, implementer require us using maize as fodder for cows than grain for our family food. When maize fodder is given to cow, community might get natural calamity of not getting rain leading to hunger*" (Woman respondent, FGDs Munjiti).

The sentiment reveals that some dairy farming technologies practices may not be compatible with communities, culture and tradition. A typical example, as pointed out above in FGD, the value attached to maize crop cannot permit their use as a fodder production to feed cows. As such, training and exposure to the successful stories of dairy farming technologies could help to break the long-time culture and tradition.

From the argument, it can be concluded that persistent cultural values and norms lead to gender inequity and inequality in term of household hierarchy of powers, resource ownership, participation and role allocation which as a result determined adoption of dairy farming technologies. The statement is supported by the observations made by Makokha(2005) were that traditional norms and historical injustice on women are a hindrance to adoption of dairy farming technologies. The findings on lack of dissemination of the legislation to the grassroot are in line with a study by Muriuki et al. (2017) who observed that there are many publications on policies related to dairy development and gave an example of the National Livestock Development Policy which has not been disseminated in rural areas and affected processes in adoption of dairy technologies. Besides, Anuonka et al. (2015) posited that women's access to, ownership of property and rights especially in regards to land, were a basis for adoption and survival of technologies. Likewise, the social cognitive theory of gender development and differentiation Bassey and Bandura (1999) can be employed which holds that gender differences are socially constructed; and most of the stereotype's attributes, and gender roles arise from cultural norms/practices.

Cost and Characteristics of Dairy Farming Technologies

Table 1 shows 22% of the respondents indicated that cost and dairy farming technologies characteristics were a key determinant in adoption. This was consistent with socio demographics characteristics where women respondents disclosed an average income per month of Ksh. 2000 obtained from off farm activities. This kind of income would make adoption almost impossible due to its direct competition with the basic needs' requirements. Key informant expressed low income coupled with low knowledge on resource mobilization, savings, and lack of registration of rural women dairy farmers groups as legal entities, relegated rural women to spectators of technological investment. Adaptability of dairy farming technologies is a factor of finance power. Another interview with key informant revealed low income to access to fodder production inputs and external inputs from agro veterinary supplies to manage cows. Further, banks demanded collateral; situation often difficult for most women who have no rights to family resource ownership. Rural women empowerment to form credit scheme to assist in financial needs was suggested by key informant as a reasonable approach to improving rural women income stability and promote adoption of dairy farming technologies.

In another interview, a key informant qouted cost constraints in terms of distance from extension officers, model farm training and milk market centers, as determinants in adoption. The officer argued that location from household was a factor as the further the location, the higher the likelihood that rural women would be unwilling to spend time and money to access services. This could also be attributed to workload and schedules ranging from household chores to farm work that gave rural women little time to participate in activities far away from home. Similarly, a key informant also noted that unwillingness of rural women to incur cost to adoption was caused by the nature in which dairy farming technologies were introduced into the County. The officer regretted that NGOs and the County Government smallholder dairy initiatives programmes introduced exotic cows and fodder establishment as a corporate welfare to improve household nutrition which had rendered dairy farming a social welfare item rather than an economic one in the study area. The findings from the FGDs echoed this view that cost and dairy farming technologies characteristics determined adoption. This was articulated by one respondent in FGD who said:

*"Low income from sale of vegetables and cash crops cannot meet family needs and manage technologies" (*A women in Munjiti FGDs)

From the comment, it could be deduced that rural women generate income from sale of farm produce. However, the income could not meet their respective household basic needs and in adoption of technologies. It was also reported in one FGD that there was a level of dynamics of how different resources generated within household were accessed and accounted for by household members. As such, it deems necessary for the implementers to determine intra-household resource distribution as a factor in adoption of the technologies. Combination of dairy farming technologies with other food crops that could bring faster and higher returns to meet the family basic needs and manage process of adoption of dairy farming technologies was also recommended in one FGDs.

In another FGD, discussants intimated that low knowledge on money matters, long waiting period to reap benefit, low off farm household income that could not meet pressing basic family needs, high cost of external input to manage technologies and experiences from past technologies were a limitation to adoption. On the basis of the results obtained in the study, it meant that rural women low level of financial knowledge was aggregated by structures in institutions that focused more on technical support than financial empowerment. Technological characteristic were also cited as a determinant in adoption of dairy farming technologies during FGD. It was mentioned that women were overburdened with domestic activities and any technology that would add work load was not attractive to rural women. This sentiment seems to establish that rural women are not well updated on the advantages and disadvantages of technologies. This might be a cause of them perceiving technologies as complex and labour intensive. Other comments that emerged from FGDs were use of model farms verses individual farms. Concerns in FGDs were raised that majority training was carried out in model farms that are under best environmental controls and management practices which could not bring same result when carried out at farmstead. From the basis of data collected, implementers need to show case the technologies process and results of technologies at women's household farms than at the model farms only. This would mitigate ambiguity in adoption of dairy farming technologies. Other studies conducted by Makokha (2007) and Muchangi (2016) confirm the findings that technology characteristics determined adoption among rural women.

Rural Women Farmer Involvement in Decision Making

Results in Table 1 further, show that 18% of the respondents specified involvement in decision making as determinant in adoption of dairy farming technologies. The key

informants interviewed were not certain on the involvement in decision making as adeterminant in adoption of the technologies. In one interview, key informant observed that despite the historical Luhya culture where men were the sole decision makers in all matters pertaining to household resources even where a woman had income, the recent observed trend has been men leaving women to make most of farming decisions. Seemingly, this could be due to men accepting the roles of women in farm activities and provision of family food security. The full effect of this positive move is yet to be experienced. Furthermore, it was reported that a majority men ventured into non-farm income for instance BodaBoda (public transportation using motor bikes) business, and other related white-collar jobs.

The effects of involvement in decision making in technology adoption can be twofold; from implementer's and at the household level. Implementers might be selective in technologies that meet their goals at expense of rural women realities; while at household level, the gender power relations and hierarchy of powers may limit rural women decision making in adoption of technologies. Thus, implementers ought to involve rural women in decision making. One way might be through seeking their opinion on types of technologies presented and inclusion of their men counterpart during awareness of technologies. It can also be achieved by involving women representatives in the actual discussion before a dairy farming technologies project launch. Therefore, rural women should not be perceived as adopters of dairy farming technologies only, but rather as part of dairy farming technology development.

A woman key informant objected to the idea and stressed that women could only make decision after consultation within the family, and added that it varied from family to family. The Dairy Manager who was also a key informant, she observed that decision making depended on communication structures and family priorities. Consultation, communication structures and family priorities as established influenced decision making. Therefore, creating a platform that could enable all adult individuals in a household to be involved during the awareness stage of a project could encourage women inclusivity in decision making and thus enhance adoption.

However, women in FGDs maintained that there was low level of involvement in decision making both from the dairy technology implementers and within their respective households. In one FGD, it was disclosed that authority to make decision on adoption of dairy

technologies in households was only done after consultation with adult men in family or men opinion leaders in the village. A part from consultation, respondents stated that authority was only granted by men based on perceived immediate benefit to family and as such decision making becomes a determinant in adoption. It also emerged from respondents during FGDs that men gave rights to acquire dairy farming technologies but limited rights on access and use of benefits from technologies; leading to low interest from women to adopt dairy technologies. Since gender roles and power relations issues seems to cut across all areas of dairy farming technologies adoption, there is need for the technology's implementers to know how programmes are likely to affect the social relationship among different members in households.

In another FGDs, it was established that right to decision making in household depended on marital status and type of marriage. This was held by one respondent who informed;

> *"A polygamous man does not allow women to make decision due to resource constraint and fear that if one woman adopts and other left out would bring a conflict in the family"*(FGDS Mundaha)

From the sentiment, it might mean that the level of consultations, preferences of men as opinion leaders, type of marriage and lack of authority by women to use benefits from technologies affected household decision making; hence a determinant to adoption. As such implementers should target all members of household during dissemination and also carry out needs' assessment after each stage of disseminations. This would enable to gauge the perceived benefits to individual adult member in a household. This could also increase women and men inclusion and reduce barriers to decision making in adoption.

The research further wanted to find out the mode of decision making in a female headed household in regard to adoption of farming technologies. A female key informant pointed out that a decision to adopt dairy farming technologies by single women or widows would only occur in household that had no adult men. This could mean socially ascribed gender roles are predominant in the study area that women are viewed lesser in decision making irrespective of their position in a household. Therefore, implementers should address gender power relations at every stage of awareness creation. This could be through planned field trips to other counties practising dairy farming to expose women and men to cultural diversity and women roles in dairy farming. This might be an eye opener in decision making and may result to women taking up decisions on adoption of technologies.

Another male key informant, an extension officer, stated that female headed household mostly sought the opinion of leaders in the village and dairy practitioners before they made a decision. On other hand, FGDs revealed that most of rural women could not easily come up with a decision to adopt dairy farming technologies due to fear that when a decision does not bear fruit, they would be blamed forit.

From the findings, it could be concluded that rural women involvement in decision making was a determinant in adoption of dairy farming technologies. Inclusion of rural women dairy farmers in technological process of adoption might be reasoned out to mean involvement in actual discussion before implementations and seeking their ideas at household level. Women consulting their men in decision making could be construed to mean that rural women in Khwisero lacked resource ownership, authority to fully exploit resources at their household, in addition to patriarchal structures and expectation. These might have had implication in decision making and led to low status of adoption of dairy farming technologies. These findings are supported by social cognitive theory of gender development and differentiation by Bassey and Bandura (1999) who posit that the adoption of technologies was a function of the level of inclusion and decision making by the users of the technologies.

Rural Women's Education Level

Table 1 shows 11% of the respondents indicating the level of formal education was a determinant in adoption. The level of education was an individual woman characteristic as reported in key informant interview. This was explained as a form of individual woman ability to comprehend the technologies' characteristics and attributes. Key informant argued that low level of education affected the basic processes relating to communication of information, knowledge and skills, exchanging opinions and experiences. This might have meant that formal education could create a desired change in adoption of dairy farming technologies by rural women dairy farmers.

Other responses from key informants interviewed brought out different perspectives albeit related to the level of education and behavior change. An interview with a female key informant supported the idea that level of women education a determinant to adoption of dairy farming technologies. She based this on the awareness process and stipulated that low level of education among rural women in study area inhibited the assimilation of information

and understanding of different dairy farming technologies. This might mean rural women had challenges in application of different dairy farming technologies learnt at individual household level, hence affected the adoption of technologies.

Another interviewee was also in agreement that low level of education a main problem in adoption of dairy farming technologies. She conceded that education was important in adoption as it explained individual responsiveness to change, assisted the understanding of extension education as it was taught without it being translated into another language. Accordingly, these factors could lead to loss of meaning in trying to explain technical terminologies in a local language. For instance, most technologies are scientifically researched and given English terminologies; required a level of education for individual understanding. Therefore, different pathways with different extension agents of various types and background should be used in contribution to rural women understanding and technology adoption.

There was a contradiction with a majority male key informant who said that education hadnoeffectinadoptionofdairyfarmingtechnologies.Inoneinterview,keyinformantargued that most dairy farming technology awareness was demonstrable in a model farm. He therefore concluded that rather, limited exposure of rural women to other counties where dairy farming is undertaken as a business was the culprit. Women exposure outside their local realities through exchange programmes would hence enlighten them on dairy farming as an economic enterprise according to the respondent.

It is possible that technology implementer had overlooked the importance of rural women education capacities and capabilities in adoption of dairy farming technologies. As such, joint planning during implementation and knowledge transfers might dramatically offer rural women new opportunities to close the gender disparities in adoption of the technologies as well as utilization of technologies in development of human and material resources. Another male key informant too was not in agreement that level of education per se a determinant in adoption. He expressed low allocation of funds to extension department, and synergies among implementers a determinant in adoption and follow up trainings of dairy farming technologies.

The role of the County Government to establish structures and framework for dairy

technologies implementation was observed as lacking by key informant. For instance, it was reported that structures and framework that could improve adult education and training in technologies adoption included equitable distribution of resources, decisions that influences the level and adaptable technologies in rural areas. In addition, a stronger linkage through public private sector in research, extension and training services was for sustainable adoption of technologies. This was justified by key informant as a better mechanism to stimulate learning and understanding dairy farming technologies in local context. To confirm this, the same question was raised during FGDs and respondents were of opinion that;

*"Low level of education was a hindrance to adoption because of different technologies that are taught at the same time, having different procedures to follow, and required different ways of managing them" (*FGDs Munjiti).

These observations reveal that different technologies, with different procedures of application required a level of education. In most instances, implementers packaged and created awareness of all dairy farming technologies together as expounded during FGDs. Despite a majority woman views that level of education a determinant in adoption, men key informant were of a contrary opinion. This might be interpreted to mean a lack of gender analysis on rural women and men education levels as well as assumption of implementers that based their approach on model dairy farms demonstrations. Although field demonstrations were done, rural women might require a level of education to help differentiate one aspect of technology from the other. As a consequence, the assumption could be misleading as not all rural women will perceive technologies the same way hence education became a determinant to adoption of dairy farming technologies.

The analysis of study also revealed resistant to change, unforeseen risks and uncertainty as determinant in adoption. This could be linked to the assumptions held by implementers on rural women level of education as well as approaches used in dissemination of the technologies. However, interviews with majority key informants elucidated that resistance and uncertainties' were caused by implementers desire to meet deadlines of their project goals without focusing on women socialization in terms of gender roles as well as genderdisparityinre source ownership and control. Onekey informant categorically stated that men's fear of empowered women as an impediment to adoption. He asserted that men feared women could get benefits from their resources and run away or become unruly in the home. The fear could be related to awareness that targeted more women than men in awareness.

Consequently, men not fully informed on intra- household interaction changes resulting from technologies outcome became a determinant inadoption.

Further, discussions with the FGDs revealed that:

"There is a level of resistance and risk uncertainty to adoption because several NGOs and county government extension promote same dairy farming technologies with different procedure which has penalty if not followed. They also assume all women in the groups are same with same resources within family, which is a problem" (Key informants Mundaha)

Resistance to Change And Unforeseen Risks And Uncertainties

From the above comments, it could be implied that the level of resistance to change and fear of unforeseen risk was as a result of different assumptions and procedure on dissemination of technologies that override the existing women practices. It could also be deduced to mean uncertainties were as a result of failure of NGOs and county government as implementers to embrace aspect of social justice during implementation of dairy technologies. As such, rural women might have felt lack of fairness and equalities, as a right to all members in the community; in the outcome of development, through processes of socialtrans formation. This could in addition, inform, that implementers tended to put their project interests first without putting into consideration the needs and local realities of rural women in study area. This may conceivably be a source of resistance to change, unforeseen risks and uncertainties'; thus, a determinant in adoption of dairy farming technologies. This study findings on level of education, resistance to change, unforeseen risk and uncertainties' are in line with Gitonga (2010) and Obayelu et al. (2017) studies in Kenya, Ethiopia and Nigeria respectively that process of technology awareness and farmers exchange programmes determined adoption of technologies. The finding is supported by Makokha (2005) and Nalunkuuma(2013) studies' outcomes positing that resistance to change was an aspect that led to less effort in adoption of dairy farming technologies by rural women. It is also in line with innovation diffusion theory of Evertt (2003) which held that adoption of technology is determined by the process of diffusion from one system to the other.

CONCLUSIONS

The study established different determinants of dairy farming technologies. These were cultural values and norms, cost and dairy farming technologies characteristics, level of

women involvement in decision making to adopt technologies, fear of unforeseen risks and uncertainties, rural women level of education as well as resistance to change. The study also identified that cultural values and norms led to gender inequity and inequality in term of household hierarchy of powers, resource ownership, participation and role allocation which as a result determined the level of adoption of dairy farming technologies. In regard to cost and dairy farming technologies characteristics, the study learned that rural women low income, low knowledge of resource mobilization, and distances to access information and inputs determined adoption. Furthermore, the level of rural women involvement in decision making was established as determinant in adoption. This was linked to two folds; implementers and at the household level. The study established that implementers put interest on project goals at expense of rural women gender needs. In addition, it was found out that household power relations and hierarchy of power limited women decision making in adoption. On other hand, the study identified fear of unforeseen risk and uncertainties attributed to lack of gender inclusion in technology awareness. The level of education was perceived as determinant to adoption. This was also identified in demographic characteristics that a majority rural woman in study area had primary level of education. The low level of education was associated with lack of women exposure to other counties practising dairy farming as a business.

Therefore, the study therefore recommended that implementers take affirmative action and ensure direct participation of women and men in dissemination of technologies. This would account for unified knowledge and input on gender roles in adoption of technologies. In addition, dairy development agencies oughttouse multi-sectorial and multifaceted approaches in order to minimize constraints in adoption of dairy farming technologies among rural women in study area.

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