

## **Adoption of Innovative Livestock Technologies: Potentials and Constraints among the Smallholder Farmers**

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### **Abstract**

The study was undertaken to know the features of implementation and identify the conveniences and limitations of innovative livestock technologies to facilitate the researchers and farmers for refining the adoption level as well as to enhance the animal and poultry productivity. The north-central part of Bangladesh was chosen and 4 different agro-ecological zones were selected for the study. Categorical data were gathered from the selected farmers through oral interviews and they were presented graphically. Technologies were developed mostly for research and industrial uses by the researchers but they were not adopted sufficiently by the farmers. Farmers adopted the technologies mainly to get more production and income generation. Farmers had easy access to improved breeds and vaccines and moderate access to off-farm activities and transport facilities. Lack of availability of disease control technologies and absence of proper demonstration were the common and frequent constraints for the smallholder adopters. Also, inadequate information for access to technologies, lack of technical knowledge and absence of reliable technical assistance were the remarkable problems in adoption. It is recommended that farmers should have easy access to extension offices, providing input subsidies and special financial interventions for the higher rate of adoption of innovations by the smallholders.

### **Key words**

Adoption, Constraint, Innovation, Potential, Smallholder

### **Introduction**

An innovation is an idea or practice that is perceived as new by the separate or other part of adoption, which is a choice to use an invention as the greatest sequence of action obtainable (Roger, 1995). Technology adoption is the implementation of knowledge acquired about a specific innovation (Bortamuly and Goswami, 2015). Innovation of new technology and their adoption are important components that would enhance productivity in agriculture. Access to

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information, which is directly related to extension services, visits and farm trials are very essential for the adoption of newly formed technologies (Feder et al., 1985). Some of the research institutes and universities in the country have carried out a lot of research in developing improved technologies to solve the problem of low productivity, yet the levels of adoption of the technologies have remained low. The reasons for this are due to a combination of factors like faulty agricultural policies, poor institutional framework, unfavorable socioeconomic disposition of producers and distorted consumer preferences. Tremendous efforts have been made by the agricultural and livestock institutions in Bangladesh to generate, disseminate and adopt the appropriate livestock technologies. Presently, there is no information available that adequately characterizes existing informal and formal adoption of innovative technologies, which is one of the major problems in Bangladesh. The livestock development system has not been able to deliver the messages and/or did not succeed in facilitating farmers to implement the proposed technologies.

Information problems (farmers do not know the technologies) and training problems (farmers heard about or even saw the information but do not know how to implement it) are the two major problems faced by the farmers to improve agricultural production activities. Yet livestock husbandry has not been developed on a commercial basis due to low adoption of scientific management practices with innovative technologies. A large number of the farmers faced problems in adopting these innovative technologies (Sathiadhas et al., 2003). Hence, some of them ignore such practices and the adoption level of scientific farming practices is found to be not at a desirable level. But, there are some facilities for the farmers to adopt these technologies. At the same time they face a number of problems in deciding to adopt the innovations. Previous research has shown that outward constraints are the basic causes for the poor farmers having less-asset in technology adoption (Nhemachena and Hassan, 2007; Challinor, 2007). Moreover, the presence of one constraint sometimes aggravates others and enhances obstacles to adopt a technology (Zander et al., 2013). So, it is essential to investigate numerous constraints concurrently (Jack, 2011). To increase the country's livestock production as well as the small-scale farmers' socioeconomic conditions innovative technologies should be adopted properly. Hence, it is necessary to know the information of innovative technologies and the related potentialities and constraints to adopt these technologies. The findings of this research will provide important information for government and policy makers to facilitate the introduction and adoption of innovative technologies. The present study is, therefore, undertaken to know the reasons and status of adoption of innovative technologies and to identify the possibilities and constraints perceived by the farmer.

### **Methodology**

Four ecologically expressive localities like a rural plain land, a hilly high land, a river flooded low land and a peri-urban location were chosen purposively from the north-central region of

Bangladesh. Using simple random sampling techniques 45 livestock farmers who used at least an innovative technology from each site were selected. The prime data was obtained through oral interview from selected household heads by a structured questionnaire. The interview schedule was pre-tested previously the actual data collection allowing the adjustments of certain questions, which were immaterial to the existing condition. An enumerator was appointed and trained up in the context of the interview schedule, method of data collection and on the proper way to contact the technology users. Consistent monitoring was reached by the researcher on the spot and also made direct interaction with the farmers for interview. A few cases farmers were hesitant to converse or reveal the information. They were interviewed after politely convincing them by explaining the importance of the research. Even local leaders accompanied the researcher to establish a trustworthy and friendly atmosphere.

Typically categorical answers were asked to the researchers for their purposes of technology development. Similarly, categorical answers were recorded from the farm holders who used one or more listed innovations to know their level of adoption and in what purposes they implemented them. Also, they were asked on potentials and constraints regarding use of technologies. Adoption level of self practiced innovation by the farmers were measured by scoring the level of technology used. Similarly, the proportion of a facility and a constraint in use of innovations was determined by the number of farmers perceiving the facility and problem respectively, divided by total number of farmers and expressed as percentage.

## Result

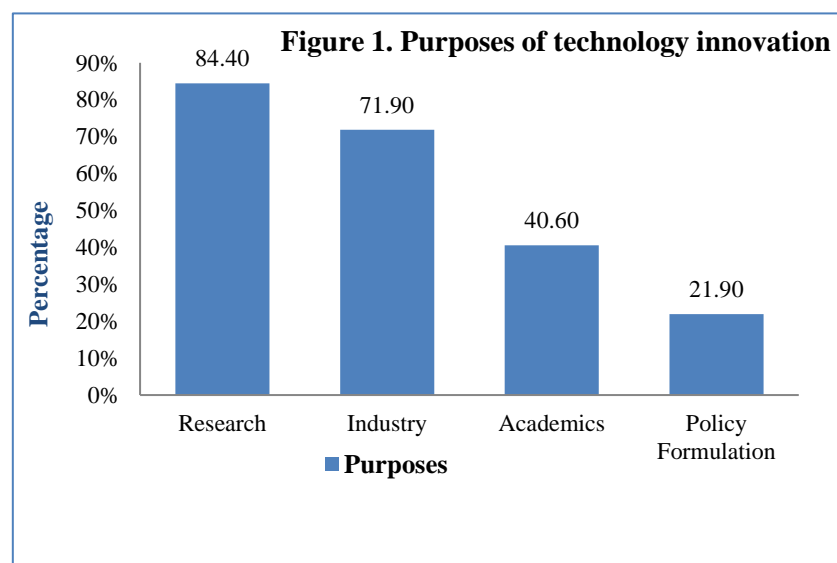
*Innovative technologies:* Livestock researchers in Bangladesh have innovated and developed a large number of technologies. Most of them were developed for research, academic and policy formulation and industrial purposes. The investigated researchers opined (each researcher responded multiple answers) that technologies were developed for research purpose 84.4%, industrial use 71.9%, academic purpose 40.9% and policy formulation 21.9% (Figure 1). Most of them are not used sufficiently at the field level but some of them have moderate use. Some of them are being used in research institutions. About 29 technologies were innovated or developed by the scientists of agricultural universities, research institutes and NGOs in Bangladesh of which 13 related to processing and disease control, 8 related to increase ruminant production and remaining 8 related to rise poultry invention (Quddus, 2022).

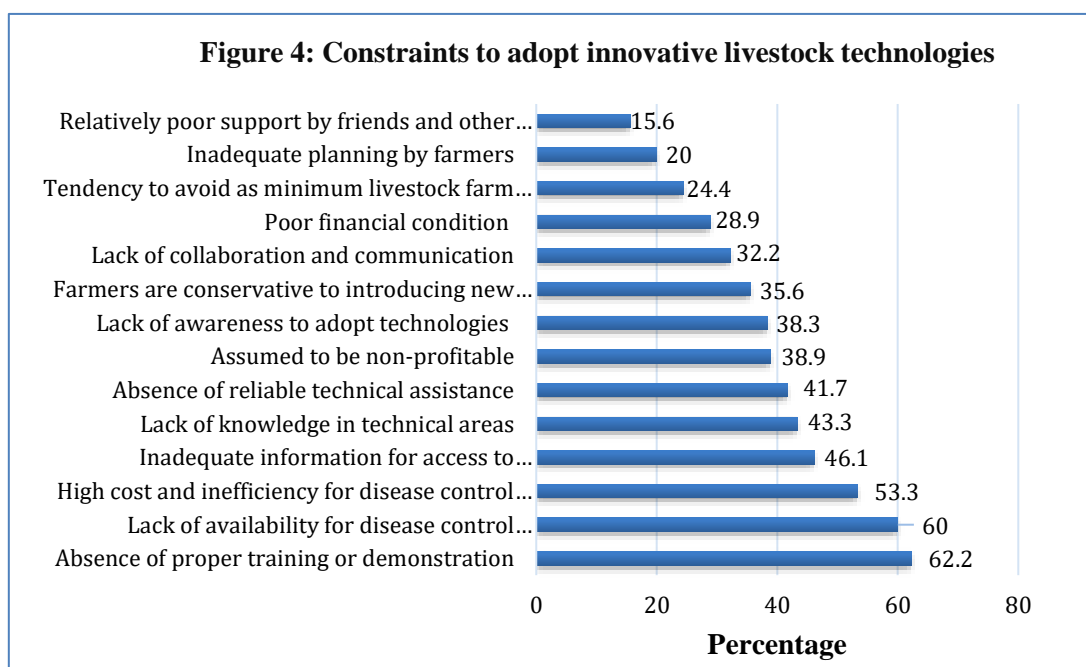
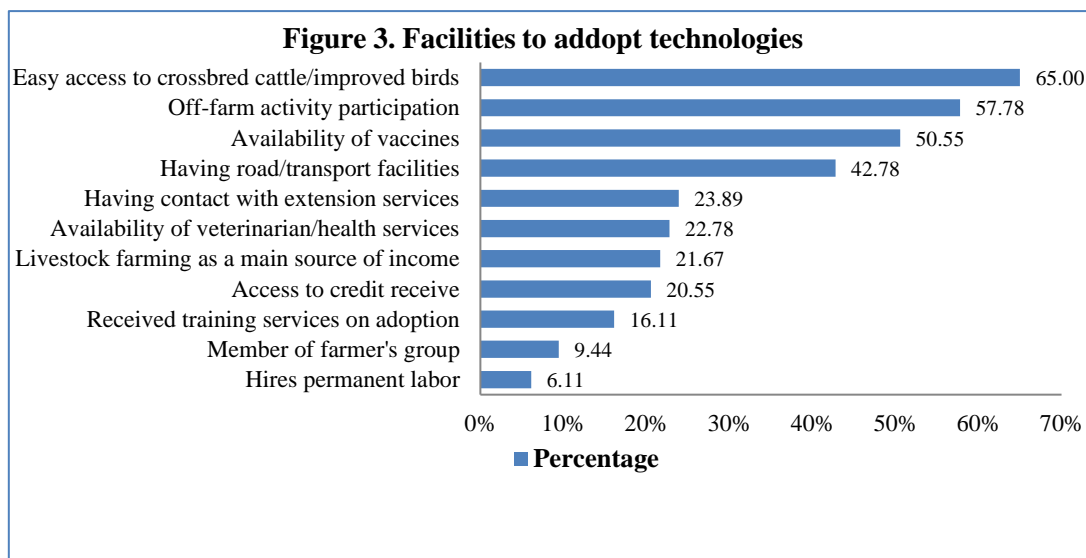
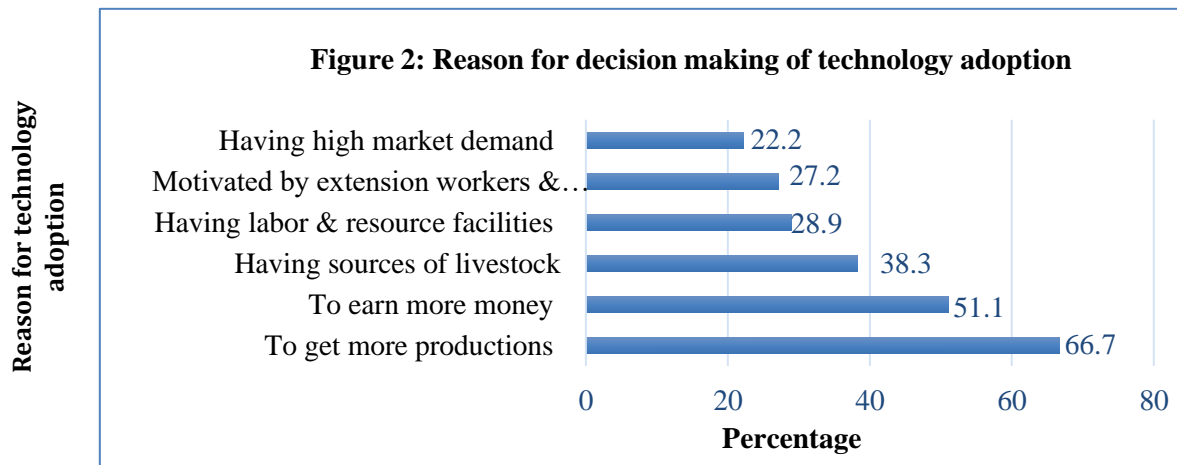
*Reasons to decide adoption of innovative technologies:* One hundred and eighty small farm livestock households had adopted livestock technologies for dairy cattle, beef fattening and chicken either regular or at some times. Out of these adopters, 120 (66.7%) adopters decided to adopt livestock technologies to get more productions for consumption and or sale the livestock products and 51.1% for income generation. About 38.3% farmers opined that they had sources of animal or poultry feeds and 28.9% had available labor and resource facilities to

adopt technologies. Whereas, 22.2% farmers got high market demand for animal or poultry products and 27.2% were trained formally and or motivated by extension workers for technology adoption (Figure 2).

*Facilities:* All the livestock farmers were asked the questions on existing facilities available in their location to adopt innovative livestock technologies. Sixty five percent of the adopters had easy access to crossbred cattle/ improved birds and 50.55% had availability of vaccination (Figure 3). Off-farm activity participation and having road and transport facilities were for 57.78% and 42.78% adopters respectively. Access to credit, receiving of training services on adoption and having contact with extension services for livestock farming and technology adoption were 20.55%, 16.11% and 23.89% respectively.

*Constraints:* Absence of proper training or demonstration was the most common and frequent constraint (62.2%) and ranked one. Lack of availability for disease control technologies and high cost and inefficiency for disease control technologies were the next highest constraints (60% and 53.3% respectively). Inadequate information for access to technology, lack of knowledge in technical areas and absence of reliable technical assistance were ranked 4, 5 and 6 respectively (Figure 4). Approximately 39% farmers assumed that prescribed technologies were non-profitable in the production process and lack of awareness to adopt technologies. The next constraints were the lack of collaboration and communication, poor financial condition, tendency to avoid as minimum livestock farm resources, inadequate planning and poor support from friends and other farmers were the remarkable constraints to adopt innovative technologies by the smallholder farmers.





## Discussion

Technological advancement and adoption has yielded positive returns on investment but adoption rate is lower amongst resource-poor households in the study areas. About a half of the households had adopted a negligible number of technologies. The reason for lower adoption is primarily related to the limitations of the household's socioeconomic conditions, especially, lack of money. In most of the cases livestock owners worked on themselves and they did not hire paid laborers due to low income and higher salary. However, significant adoption and commercialization of emerging technologies has not been achieved in Bangladesh, due to a combination of cultural beliefs, ethical concerns, regulatory delays, lack of information and understanding of the science and technology being used. Most technologies were adopted by only a small and common proportion of the sample households, who are better resource holders or live in more favorable areas, especially in the peri-urban areas having contact with researchers and extension services. Farmers seem to prefer keeping mixed livestock rather than a herd of one single species only. A large number of farmers favor native breeds of cattle because they are additional liberal to diseases, unnecessary feed, do not need very urbane and concentrated management (Petrus et al., 2011) and another cause may be because of the poverty they are incapable of buying high yielding crossbreds. Greater understanding of origin causes of low adoption would serve as a guide for technology developers to develop better strategies. However, by using the transferred technologies farmers were gained in production as well as service and financial profit such as milk production and reproductive performance of cows has improved for their livelihoods. Also, it would certainly contribute to ensuring g food security of the livestock farmers.

Farmers having higher levels of income make better use of innovative farming techniques (Kinnucan et al., 1990), as they feel more comfortable to be in the position of taking financial risks. Access to crossbred cattle and availability of vaccines were found at higher levels of adoption facilities in the studied areas. But, rearing crossbred cattle is too expensive to most of the farmers for high primary investment as well as high upkeep cost (Quddus, 2017), especially, high price of concentrates (Kumar et al., 2011). Also, off-farm activity participation and having road and transport facilities were reasonably indirect scope of the farmers. Access to credit receive, reception of training, extension services and health services for adoption of new technologies are very essential, which agree with the findings of (Mohamed and Temu, 2008; Rahman et al., 2023). But these services were not reasonable in the study locations.

Most of the prescribed technologies were newly innovated and they were not familiar to farmers due to lack of knowledge, demonstration, technical assistance or information. Hence, the farmers got various constraints with regard to adoption of innovative livestock production technologies of which absence of proper training or demonstration was the most common and frequent. Therefore, inadequate information for access to technologies, lack of knowledge in technical areas and absence of reliable technical assistance were the more frequent constraints. Extension services are much lower compared to Zander et al. (2013) who stated that 83% of

the farmers had regular contact with extension services that provided advice on new technologies and livestock production innovations. The credit obtained by the trainers was more advanced than the non-trainers (Akteruzzaman et al., 2008) and the farmers faced major problems in this regard for livestock husbandry due to their poor economic conditions (Hossain et al., 2000). Low production cost and low labor wage could stand as an advantage to adopt livestock technologies. But high cost of inputs and higher rate of wages are the serious constraints for improved livestock farming and adoption of newly invented technologies in Bangladesh. Labor availability had positive and significant influence on adoption and intensity of adoption of livestock technologies but availability of permanent labor was the serious problem in this study.

The knowledge of an innovation is prerequisite for its adoption and higher knowledge of the technical nature of improved practices lead to a high adoption. But lack of education and inadequate knowledge for technology use in this study is a remarkable problem and it agrees with study by Chagunda et al. (2006). Highly educated people could adopt new technologies potentially earlier than the less educated as they have more knowledge and can easily access information necessary to make an early adoption decision, but the education level of the studied livestock farmers is generally low. Some studies have established positive correlation between educational attainment and adoption of modern farm innovations (Atala, 1984) and educational enlightenment facilitate access to information that could influence adoption behaviors (Bolorunduro et al., 2004). Difficulties connected to latest technology adoption are not continuously intrinsic or the attitude of information dissemination. But could be a direct reflection of the social inequalities and economic disparities that already exist in the society and of environmental challenges and constraints (Croppenstedt et al., 2011). Research on adoption of technology to alleviate climate alteration results has exposed that the exterior restraints are the basic reason behind in technology adoption by resource-deprived smallholders (Nhemachena and Hassan, 2007). The farmers stated that they faced difficulties in the management of crossbred cattle and use of other technologies and sometimes suffered difficulties to sell their products. A large number of cattle breeding technologies have been adopted in recent years but still there are so many constraints facing the small farm holders.

Also, a large proportion of the farmers get insufficient veterinary services from veterinary experts and continue to keep their animals in the traditional and unhygienic environment with poor ventilation, which results in the health problem of the animals. Unavailability of adequate veterinary services is a serious problem for livestock farming as well as technology adoption for the farmers. Similar problems faced by 47.2% farmers (Quddus, 2012) and 48.3% farmers (Mohi and Bhatti, 2006). This finding also agrees with the findings of Dey et al. (2012) and Bhutia et al. (2017). Most animals were not vaccinated, only 6.5% were vaccinated (Rabbi et al., 2014) and lack of awareness of goat owners for vaccination and inadequate veterinary services with vaccines (Imtiaz and Rana, 2014). Lack of vaccine facilities is not a problem in this study but lack of knowledge and awareness of its importance and uses is a remarkable problem for a large number of farmers.

## **Conclusion**

Adoption of a new technology involves some risk and uncertainty on the productivity of livestock. Thus, farmers should be inspired to make decisions themselves in implementation of a new technology. Livestock extension activity is not strong in comparison with crop extension. Thus, proper government policy and monitoring is very much essential for livestock extension activities. Farmers are not much willing to use technology in the study area, especially in the hilly and low-lying areas, as they were unaware of livestock production technologies due to lack or inadequate information and extension services. Thus, it must increase the frequency of extension visits to farmers and should initiate intensified training programs for the rural youths and for extension agents by strengthening their competency. Government organizations and researchers of livestock should contact farmers periodically to motivate and increase awareness to change the social perception of adoption of technologies. The Government should also provide extension services with sufficient financial, material resources and human resources along with special interventions.

Higher educated people and farmers having higher income could enhance diffusion of innovations and potentially would adopt new technologies earlier than the less educated and farmers of lower income as they have more knowledge and can easily access to information necessary to make an early adoption decision. Thus, the government should emphasize on educating young farmers to enrich technology adoption with more animals or birds. Locations where the farmers are in touch with innovations, quality inputs and proper guidance were found to have significantly higher probability to increase the adoption of innovative livestock technologies. To adopt improved technologies sufficiently by small farm holders, it is recommended that the government should make inputs available easily to the farmers at a cheaper price or provide subsidies. Therefore, to enhance technology adoption by farmers, it's important for policy makers and developers of new technology to understand farmer's needs as well as their ability to adopt technology. The study recommends the future studies on adoption to widen the range of variables used by including perception of farmers towards latest technologies, particularly those variables are expected to be significant and positive.

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