Artificial insemination services under different institutional framework in Bangladesh

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Abstract

The objective of the study was to compare the provision of the existing artificial insemination service delivery system (AI-SDS) among public, private and autonomous institutions to the small-scale dairy farmers in Bangladesh. A cross-sectional survey was conducted by using a pre-tested and pre-designed questionnaire and face-to-face interview technique. A stratified-purposive sampling technique was applied to select 165 small-scale dairy farmers from four study areas. Descriptive statistics were performed to know the frequency of the provision of AI services. Public services were available in all study areas whereas autonomous services were only delivered in Mymensingh district. The private service was increasing faster than the public and autonomous service. The public service had higher incentives and network coverage compared to private and autonomous services. The results also showed that 50% of the respondent perceived the AI service as "public goods" and showed no willingness to pay (e.g., free of charge for public service). The demand for the services has been increasing but the existing organizations were not able to provide the services especially to the remote areas. From this study, it is recommended that farmers' needs should be translated in a way that they get access to their required services in a satisfactory manner.

Key words: Artificial insemination, Institution and Organization, Service delivery System

Introduction

Livestock plays an important role in the national economy of Bangladesh. The share of the livestock sub-sector, in 2011, to the national gross domestic products (GDP) was 2.79%, which was 16.5% of agricultural GDP (Bangladesh Economic Review, 2011). Dairying is an integral part of crop-livestock system and this is particularly important for the rural poor, including the functionally landless, many of whom regard livestock as a main livelihood option (Saadullah 2001; Uddin et al. 2011). About 75% of the rural people rely on livestock, particularly dairy, to some extent for their livelihood, which clearly indicates that the poverty reduction potential of the livestock sub-sector is high (DLS 2007; Upton 2011). Livestock development is considered an intermediate step to boost the overall economic development of the country and ensure the animal protein security.

To meet the growing demand and ensure adequate amount of protein from animal source and thus, food security at household level the famers need to increase their productivity. The existing low productive local cattle, low production of milk and meat and low investment in the sector are the major challenges towards improvement of livestock sector (Jabbar et al 2005; Khaleque et al. 2012). In addition, lack of appropriate breeds, suitable breeding policy and shortage of feeds and fodders throughout the year are also hindering the productivity (Bari 2008; Khan et al. 2009). The government intervention to overcome those problems by importing high yielding temperate breeds could not bring a solution to increase productivity. This instigates to search for alternative options; one of which is to infuse the exotic blood into the best local cows through either upgrading or crossbreeding. This leads to a key question: which tools are the best to implement upgrading

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or crossbreeding in order to enrich the genetic merit of the existing breeding stock and whether existing institutional framework are able to implement those tools at the farm level?

To answer to this question, artificial insemination services was considered as a significant vehicle to improve the existing reproductive performance of cattle breeds by implementing the cross-breeding (Uddin et al. 2010). Although the history of research into artificial insemination (AI) is over two centuries old and its commercial application has now already span 75 years, in Bangladesh, AI has first been introduced just in 1959 during the then East Pakistan (Shamsuddin et al. 1987; Alam and Ghosh 1988). The extension as well as commercialization of AI service started and gained reputation in 1975 (Ali 2003). The prospect of AI continues to be promising reproductive technology due to three cornerstones of its application which are: it is simple, economical and successful (Vishwanath 2003). Although the immediate result of using AI is the impregnation of the female, the real benefit of using AI is that it gives all farmers the possibility of gaining from genetic improvements created elsewhere, privately or collectively.

In Bangladesh, AI services have been operated commercially by both government and private organizations whereas the autonomous organization provides the AI services within their research and extension strategy. All the government cattle breeding activities are performed by the DLS (Department of Livestock Service) - a base organization working under the Ministry of Fisheries and Livestock. The AI services are mainly delivered by District Artificial Insemination Centre. There are 23 centres covering the 64 districts of the country. Each centre has several sub-centre and AI points. All the district AI centres are coordinated by the Central Cattle Breeding Station (CCBS) located in Dhaka. There are 423 sub-centres and 554 AI-points. In addition, there is also private level AI activity which has been operating very recently. Until 2000, the provision of AI services for small holders has generally been only in the hands of government leading to erratic, insufficient and unreliable delivery system. In cases where the benefits of services accrue to the owner of the animals, privatization of the AI services may

improve the delivery system. Due to the government recognition on the need the participation of the private sector in increasing service delivery system, the policy was liberalized in 2001 to allow private organization in the AI-SDS. Within such policy, the private level AI activity has been operating after the signing the agreement between the government and BRAC (it was formerly called Bangladesh Rural Advancement Committee) in 2001. In contrast, the profit-oriented and exploitative role of the private sector has clearly articulated the need to have stronger regulatory bodies, institutional mechanisms that will facilitate the private investors to comply with institutions regarding the delivery of AI services mentioned in the agreement (DLS, 2001) for increasing the effective service delivery system to the small-scale farmers (Khalequ et al. 2012).

However, in order to open up the government policy to include private organizations in AI-SDS, the question arises as to which extent the provision of these services by private organizations is of comparable in terms of service area coverage, farmer's access, farmers affordability (e.g. economic benefit) and quality to that of public organizations. Therefore, it is necessary to conduct research on the provision of AI services across the organizational structure. Until now, no study has been documented in the literature that compares the services provision among the various organizations. Hence, the objective of this study is to compare the AI services delivery system (AI-SDS) among public, private and autonomous organizations.

Materials and Methods

This study was conducted in four districts such as Comilla, Brahmanbaria, Narayangonj and Mymensingh districts. The reasons for selection of these districts were due to the fact that each of the districts represents diverse characteristics in terms of demography, socio-economics, institutions and organizations, livestock production and agricultural farming systems. The district of Comilla represents the high density populated areas where the farmers have more dependence on off-farm activities. Regarding institutional perspectives, District AI Centre (DAIC)-a public organization for providing AI

services to livestock farmers is situated in this district. The Brahmanbaria district is typically low-lying area where farmers depend mostly on rice production and fish culture as compared to livestock production. In relation to institutional perspectives, there is no DAIC in this district though it has AI sub-centres and AI-points. The farming system of Narayangonj district represents the urban farming system where the farmers have more access to off-farm income than other three districts. The district of Mymensingh is different from other three districts because of the presence of both DAIC and autonomous AI service provider. Bangladesh Agricultural University (BAU), as an autonomous organization, is situated in this district and delivery the AI services to the neighbouring areas.

The data were collected from 165 farmers based on the criteria that each of the farmers had an equal option to access and use AI at least one of the three service providers. The stratified-purposive sampling technique was chosen pertaining data to fulfil the objectives of this study.The distribution of sampling farmers were as follows: Comilla: n = 40 using both public and private, Brahmanbaria: n = 30 using both public and private, Narayangonj: n = 35 using both public and private, and Mymensingh: n = 60 among them, n =35 use state and n = 25 use autonomous services. The services provided by the DAIC was considered as public AI service, while the private AI service was provided by the BRAC-a Non-governmental organization. The autonomous service was provided by the BAU AI centre. However, the program for providing private AI services are limited to some areas due to an institutional agreement with the public organizations enabling the private AI services to operate only in the areas where public services were not reachable. In the present study, purposively private services that operate their services parallel with other providers were selected.

The data were collected with the help of a pre-designed, pre-tested and structured standard questionnaire containing both open and close-ended questions. The questionnaire was designed to cover three broad areas of information such as farm and farmer characteristics, information related to the provision of AI services and outcome/performance efficiency in public, private and autonomous organizations and information related with the governance structure.

The data were classified into three groups: public, private and autonomous in order to compare the provision of AI-SDS across different institutional arrangement. The key variables that were used to know the provision of AI-SDS were: AI service provision structure, trend of the service, level of incentives, transaction cost, service coverage, farmers' access to complain to the organization and their willingness to pay (WTP) especially for the public services. In addition, a number of farm specific socio-economic factors were also analyzed to understand the characteristics of the farmers and their farming system. The data collected from the personal interview were subjected to statistical analysis with SPSS statistical packages.

Results

Farms and farmers characteristics

The major variables that reflect the farmers' characteristics were the age, gender and level of education which are depicted in Table 1. In terms of age structure, most of the farmers were between 45-60 years old that corresponds to 45.5% followed by 31-45 years (42.4%), 15-30 years (9.1%) and above 60 years (3%). With regards to the gender, most of the farmers interviewed were male (67.9%) whereas 32.1% represent the females involved in cattle farming. Concerning the level of education, the most of farmers (representing 48%) have secondary education whereas 19% do not have any education.

Livestock, with particularly dairying, is integrated with crop production as 37% of the farmers produce only rice in addition of rearing livestock while 49% produces rice in a combination with wheat and vegetables. This indicates that the small-scale dairy farming systems are well integrated with on-farm and off-farm activities as shown in the lower part of the Table 1. The same is reflected in the off-farm activities as only 94% of the farmers somehow involved other than dairy activities and receive an amount that varies as lower than 2000 to more than 12000

BDT/year. Since dairying alone is not enough to meet the daily needs, farmers depend on off-farm activities. The farm size varies from 1-3 to <10 cows. Half of the farmers have a herd size of 1-3 and 25% have 4-6 cattle per farm. This again reveals the relatively lower herd size of the small-scale farming system in Bangladesh.

Table 1. Characteristics of the farms and farmers in the study area

Characteristics of	Variables	Category	Frequency	%
Farmers	Age	15-30 years	15	9.1
		31-45 years	70	42.4
		46-60 years	75	45.5
		Above 60 years	5	3.0
	Gender	Male	112	67.9
		Female	53	32.1
	Level of Education	No education	19	11.5
		Primary	44	26.7
		Secondary	48	29.1
		Higher secondary	34	20.6
		University	20	12.1
Farms	Crop-livestock integration	No crop	24	14.5
		Rice only	61	37.0
		Rice + Wheat	20	12.1
		Rice+Vegetables	16	9.7
		Rice + Wheat + Vegetables	44	26.7
	Off-farm income	No income	10	6.1
		<2000 BDT*	37	22.4
		2000-4000 BDT	23	13.9
		4000-6000 BDT	27	16.4
		6000-8000BDT	18	10.9
		8000-10000 BDT	17	10.3
		10000-12000 BDT	20	12.1
		> 12000 BDT	13	7.9
	Number of cattle	1-3	81	49.1
		4-6	42	25.5
		7-9	26	15.8
		>10	16	9.7

* 1 BDT = 0.01 €; n = 165

The provision of AI in different regions and organization

The AI services provided by the public, private and autonomous institutions and farmers access to those services are depicted in Table 2. The public and private services are available in most of the areas accounting to 63.6% whereas the autonomous service availability is strict to only in Mymensingh districts. While comparing AI service delivery among public, private and autonomous organization individually, it is also evident that public AI service dominates over the private and autonomous organization in all the areas. The public AI service corresponds to 84.8% (Author's calculation, is not shown) whereas the private and autonomous together corresponds 15.2%.

Table 2. Farmers access to the AI service provision

Location	Pubic + Private		Public + Autonomous		Private + Autonomous	
	Frequency	%	Frequency	%	Frequency	%
Comilla	40	24.2	N/S		N/S	
Brahmanbaria	24	14.5	N/S		N/S	
Narayangonj	41	24.8	N/S		N/S	
Mymensingh	N/S		35	21.3	N/S	
BAU	N/S		0	0	25	15.2
Total	105	63.6	35	21.2	25	15.2

N/S, Services not available

Trend of service provision among the different organizations

An increasing trend of AI service provision as perceived by the respondent is observed for all three organizations (Figure 1). The highest increase in private organization (60.6%) is followed by public (55%) and autonomous (45.6%). In contrast, about 19.4% of the farmers perceived that autonomous service provision is decreasing while a majority of the farmers still perceived a stable service provision accounting for 39, 34 and 35% for public, private and autonomous, respectively.
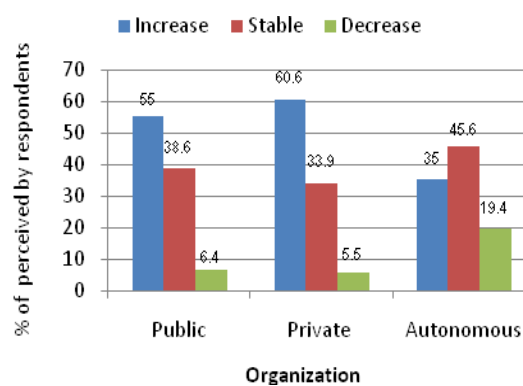

Figure 1. Trend of AI Services among the organizations

Provision of incentives for using AI services

The incentives for using AI is defined by the additional support services that consist of the direct cash payment to the farmers or AI with follow up on the development of conception of the cows as well as diagnosis for reproductive diseases. The study revealed that state AI-SDS is accompanied with incentives of 45% varying from very high (2.8%) to very low (7.8%) (Table 3). On the other hand, most of the farmers receive no incentives ranging from 55% for state, 74% for private and 85% for autonomous organization.

Table 3. The provision of incentives perceived by the respondents among the organizations

Organization	Incentives	Frequency	%
Public	Very high	4	2.8
	High	3	2.1
	Moderate	21	14.9
	Low	24	17.0
	Very low	11	7.8
	Nothing	77	54.6
Private	Very high	1	1.0
	High	3	3.0
	Moderate	5	5.0
	Low	7	7.0
	Very low	10	10.0
	Nothing	74	74.0
Autonomous	Very high	0	0
	High	1	1.7
	Moderate	1	1.7
	Low	3	5.0
	Very low	4	6.7
	Nothing	51	85.0

Transaction costs for different organizations

The extent of transaction costs (in terms of time/dose of AI service, money spent/hour and physical labour (km walk/dose of AI service) incur during uptake of the AI service are depicted in Table 4. The level of transaction costs ranging from high to very high is evident as 74, 87 and 100% for state, private and autonomous organization, respectively. The autonomous institutions rank the highest (71.7%) transaction costs over private (53.5%) and state (47.1%). In case of public service, the high, moderate, low, very low transaction cost were found 38%, 29%,

4%, 3%, respectively while those for private are 33%, 9%, 1%, 1%, respectively.

Table 4. Transaction costs among the organizations

Organization	Transaction	Frequency	%
Public	Very high	66	47.1
	High	38	27.1
	Moderate	29	20.7
	Low	4	2.9
	Very low	3	2.1
	No transaction costs	0	0
Private	Very high	53	53.5
	High	33	33.3
	Moderate	9	9.1
	Low	1	1.0
	Very low	1	1.0
	No transaction costs	2	2.0
Autonomous	Very high	43	71.7
	High	17	28.3
	Moderate	0	0
	Low	0	0
	Very low	0	0
	No transaction costs	0	0

0 = 0% of the farmers have such transaction costs

The AI service network coverage

The distance from the farmer's home to the source of the AI service delivery center is represented in Figure 2. The distance is measured by a radius of 8 km from the center (nearest to the peripheral). According to government policy, 100% of the respondent should receive AI services within this radius but from this study it has been observed that only 47.30% of farmers found the source of AI service within 8 square km in case of public AI-SDS whereas those for private and autonomous were 21.20% and 12.10%, respectively. Moreover, 19.40% farmers found no source of AI service within even 8 Km^2.
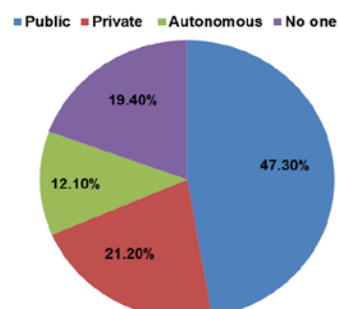
The farmer's access to the AI-SDS and institutional willingness to accept the farmer's complain

The farmer's participation in the service delivery system is measured by the level of interaction between the service users (e.g. farmers) and service providers (e.g. Organization). One way to assess this is to measure the level of complexity the respondent faces in case the farmers willing to complain or to give overall feedback about their services. The nature and level of those complexities, is reported in Table 5. The present empirical study shows that 53, 61, and 70% of the farmers perceived very difficulties to access to the organization to complain for public, private and autonomous organization, respectively. Only a few of them (approximately 5-8%) face no difficulties to reach to the organization.

Table 5. The nature of the complains among the different organization

Organization	Nature of complain	Frequency	%
Public	Very difficult	74	52.9
	Difficult	29	20.7
	Moderate	30	21.4
	Easy	7	5
	Very easy	0	0
Private	Very difficult	60	61.3
	Difficult	23	23.4
	Moderate	7	7.1
	Easy	5	5.1
	Very easy	3	3.1
Autonomous	Very difficult	42	70
	Difficult	12	20
	Moderate	6	10
	Easy	0	0
	Very easy	0	0

0, 0% of the farmers can complain in such a way

The nature of the goods and services and farmers willingness to pay

The nature of the AI services perceived by the farmers and their willingness to pay for those services are depicted in Table 6. The result revealed that 47% of the farmers perceived that AI should be public goods and should only be managed and deliver by the public body. This is also reflected their willingness to pay because

about half of the respondents (49.7%) showed no willingness to pay indicating the demand for free AI services from the public body. In contrast, half of the respondents are aware on the 'free goods' and hence, showed their willingness to pay a fee in order to avoid the free riders and improve the quality of the services.

Table 6. The farmers' perception on the nature of the goods related to AI and their willingness to pay

Variable	Category	Frequency	%
Should AI be a "public goods" and only done by Public sector?	Yes	79	47.87
	No	86	52.1
Should AI be free of charge?	Yes	82	49.7
	No	83	50.3

Discussion

The effective delivery of AI services to the farmers is highly influenced by the farmer characteristics, the nature of the service provisions, the performance of the institution and organization (Uddin et al. 2010). The farm and farmers characteristics results are squarely matched by the study by Uddin et al (2011) who found the average age of the farmers between 35-55 years. The age structure clearly indicates young people are away from dairying and this might lead to problem of getting successors when the old people will go for retirement.

The farmers' characteristics are important aspects of selection of the AI services. Since the AI is an advanced technology over natural breeding the farmers need to be innovative to choose such an innovation. It has been observed that very young active population and very old which are considered as inactive population are not involved in farming activities. This could be due to the fact that a majority of the young population is either involved in higher studies or other businesses. Similarly the most of the old people are not physically so strong to run such cattle farming

In terms of gender, it is quite clear that most of the farmers were male. The reason for high percentage of males is that Bangladesh is a male dominated society where males are directly responsible for the income in the family. Although it seems that females are less in number but

32.1% of females involved in the cattle farming is not negligible, which indicates that they are also a very important labour force in the cattle farming especially for the smallholder farming system where there is no hired labour in farming. The low involvement of university graduates in cattle farming is due to the fact that they are more involved in off-farm jobs.

As concerns the herd size, most of the farmers are involved in small-scale cattle farming due to land and capital constraint. Most of the land is used for cereal and vegetable production. Due to heavy pressure on land, farmers are unable to allocate land for fodder production. In terms of crop production, as rice is the staple food of Bangladesh, farmers produce rice since they perceive that rice production has higher economic value than fodder in spite of promotion of several fodder production projects where it has clearly shown that fodder production provides better economic value than rice. The dependence of high percentage of farmers on off-farm income clearly indicates that, cattle husbandry does not generate sufficient income to cover family requirements.

Among the services provision, the public AI service corresponds to 84.8% whereas the private and autonomous together corresponds 15.2%. The higher availability of state AI service in all of the study areas is mainly attributed to its institutional arrangement. The DAIC is situated in the district level which works as umbrella organization for delivery of this services through Upazilla (called sub-district) Livestock office (ULO), and AI-points (covers within 8 Km2 from ULO. The relatively low availability of private AI services is due to the government institutional regulation which does not allow private service providers to delivery their services within 8 Km^2 (DLS 2001), more specifically where there already exist the public AI services. The least provision of autonomous AI service delivery is simply because only one institution, namely, Bangladesh Agricultural University having only one AI centers which is basically a research centre but also provides to some extent the AI services to the farmers.

Considering the overall trend of growth of services, AI services increases which might be due to the decreasing number of breeding bull due to high cost in one hand and on the other hand raising crossbred gives higher economic value than local cows. The probability of spreading vertical reproductive diseases is substantially higher in natural services (Vishanath 2003) which is only possible to overcome through use of AI. The increase use of AI is also observed in other areas of Bangladesh (Islam et al. 2010). However, the highest increase in private services, as it is expected, is due to the liberalization of AI service policy by the government (DLS 2001).

To keep the growing trend of AI services, farmers need to have incentives on their continuous use of AI services. In this regards, the State AI-SDS has better position as compared to private and autonomous which might be due to the government breed upgradation policy that is combined with the introduction of "Breed up-gradation project through progeny testing project" which provides incentives to the selected farmers for using AI from state-run AI centers and maintain breeding records for the improvement of the cattle breed in Bangladesh (Khan and Uddin, 2012). In contrast, the lowest incentives provided by the autonomous organizations might be due to the fact that autonomous AI centre is mainly a research AI centre wherein the main objective is not to provide services to the livestock producers on commercial basis and hence do not have policy frame for provision of incentives.

However, transactions costs are the key player to keep the users satisfactory. This study revealed that farmers have no option to receive AI services from any of the organization without transaction cost (Table 4). The reasons for high transaction cost in case of autonomous service might be attributed to its institutional arrangement of on-center service delivery system. The farmers must have to travel a long way with their cows for insemination which accounts for the opportunity cost of one day labour in extreme case in addition of transport cost while in case of state and private services, the inseminators go to the house of the farmers on request over mobile phone although in that case they have to pay an extra fee which is relatively cheaper than spending whole day.

Another key decision criterion to use AI services by the farmers is the network coverage. This study showed that none of the organization follows the boundary rules (see Figure 2). This may be due to the fact that private organization does not comply with boundary rules as specified by the agreement between government and private organization such as BRAC (DLS 2001; Uddin et al 2010). Interesting to note that this boundary rules are not effective in some of the study areas which may result of 21% and 12% for private and autonomous service provision within 8 km2 (Figure 2). This indicates the inefficient governance of the agreement and this has clearly articulated that this agreement has limitations in sanctioning other operators in case of non-compliance of the rules and providing services within territory of the public services.

However, the extent of the distances of the services availability with boundary, termed as the network coverage of the AI-SDS among the different organizations, is also important to consider with a view to improving the network coverage. While farmers are demanding for the nearest source for AI, the existing institutional setting is not able to meet this needs which trigger the need for institutional reform and strengthening the governance to make effective implementation of the institutions in AI delivery systems. This entails government intervention and participation in the service delivery system. The artificial insemination center-as public infrastructure and the artificial insemination service as public or quasi-public or private goods necessitates the understanding of the knowledge of institutions and governance structure for increasing the performance of this service (Uddin et al. 2010).

In order to increase the farmers' participation in the AI-SDS, it is necessary to remove the difficulties of transmitting farmers complain and/or feedback on AI service by different organization. This will show a good indicator of "good governance" and "degree of bureaucracy", respectively in AI-SDS. This finding indicates that in short-term, farmers will continue to uptake those services where they face difficulties but in long-term, the farmers will behave as "opportunity seekers" or "free-riders" and will shift the service providers from existing one once available. This might affect sharply the effective service delivery and could be a cause of obstacle to improve the service.

Nevertheless, the farmers' willingness to pay is the key determinant for successful delivery of AI services. The perceived nature of the goods and services influence the decision of the farmers regarding the use of the AI services and their willingness to pay. Since this study revealed that almost half of the farmers are not willing to pay for government AI services, government might devise cost sharing mechanism which would enhance the farmers participation in the AI-SDS in one hand and on the other hand, the effectiveness of the AI-SDS will be improved in the context of Bangladesh.

Conclusions

This study results revealed that public service provisions are widely available while the private services are also expanding higher compared to other two service providers. In contrast the autonomous service provision is strict to only particular area. The existing AI-SDS from public, private and autonomous organizations are not in the line with the expectation of the farmers. The relatively lower incentives, higher transaction cost, poor network coverage, institutional barrier to make access to the farmer's complain about their services- all make the overall service provision inefficient which need to consider by the government for their policy recommendation. The role of the government and its intervention on AI-SDS is still cannot be avoided. The key role for the government would be to monitor and regulate all other services providers while also strengthen its own service network. Hence government should initiate to reform the institutions to incorporate the needs of the small-scale livestock producers. Therefore, government should also provide the conducive policy environment to integrate the public service with other service providers with a co parable and acceptable quality and thus can enhance the ways to strengthen the institutional role in the provision of AI services.

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