TCV+ Analysis on On-line Fertiliser Recommendation: Automation of Data Processing and Data Updating

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Abstract

The key focus of this study is to find out the TCV (Time, Cost, and number of Visit) impact through a project entitled "Online Fertiliser Recommendation, Automation of Data Processing, and Data Updating" implemented by the Soil Resource Development Institute (SRDI) in Bangladesh. Fertiliser recommendation, automation of data processing, and data updating on-line are important works of SRDI. Previously, people had to go to the city or regional SRDI offices to test the soil for measuring its condition and plant nutrient status for better crop cultivation. Now, the provision of on-line fertiliser recommendation service has made the process much easier, less time consuming and less costly than the previous manual / off-line system. SRDI test soil samples and publish the fertiliser recommendations in their database. It has minimised the expenditure of the beneficiaries in terms of time and money needed to obtain fertilised recommendations for their crops. The study also focuses on the non-monetary benefits, like the beneficiaries' satisfaction, willingness to recommend the application to others and relevant indicators of this ICT based-project.

Keywords: *On-line Fertiliser recommendations, Data Processing for Soil Resource, Data Updating for Soil Resource, TCV (Time, Cost and Visit), ICT for Soil Resource, ICT for Agriculture*

Introduction and background of the Study

The Soil Research Development Institute has introduced a project named On-line Fertiliser Recommendation under SIF of a2i programme. According to its objectives, the project will automate data processing and data updating to create an easy solution for providing recommendations on fertiliser use among farmers.

In the earlier form of this service, soil could only be tested in the regional offices and in Dhaka and the results could only be collected from the respective offices. Consequently, interested parties or their proxies had to travel to Dhaka or the regional offices for soil testing to obtain the results. This entailed extra costs and time and hassles. Under the automation of data processing and data updating project, it is now possible to upload soil test results performed at different regional labs. The results can now be obtained through the Web. Thus, the contribution of the project is to make the whole process easy, as well as reduce time and cost for both the administrator and the end-users.

Bangladesh is primarily an agrarian economy. About 48 percent of its total labour force is engaged in this sector. The sector contributes to national income generating sector, to poverty alleviation, as well as to the food security of the country. Therefore, the timely recommendation for fertiliser usage based on the nature and properties of the soil tested are important information to obtain maximum benefit from fertiliser use.

Given the importance of this matter, the Soil Resource Development Institute in collaboration with "Katalyst" has undertaken a project to develop an on-line fertiliser recommendation system. Through this system, soil samples collected from the field are being sent to the laboratory for analysis. Then, soil sample analysis results are sent to the concerned parties along with location-based information and maps demonstrating the appropriate use of fertiliser.

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Literature review

A large and growing body of literature has investigated the significance of using ICT in the agricultural sector. Adamchuk et al. (2004) have stated that information about the variability of different soil attributes within a field is essential for making the decision regarding which corn to be cultivated. They highlight that the inability to identify soil characteristics lead to reduced production. Alam et al. (2006) evaluated the leaf colour chart (LCC) as a simple tool for improving fertiliser N use in rice and wheat in farmers' fields of southwestern Bangladesh. They found that use of the LCC for Nitrogen management consistently increased grain yields and added net returns for rice and wheat as compared to the farmers' fertiliser practice across two rice and two wheat seasons. Kitchen (2008) found that precision agriculture information increases in value when data collection, data processing, and management actions are integrated.

Furthermore, Shinde et al. (2015) in their study "Web Based Recommendation System for Farmers" opined that currently recommendations for farmers are based on a one-to-one interaction between farmers and experts and different experts have different recommendations. They found that it is fruitful to provide recommendations to farmers using past agricultural activities with help of data mining concepts. Thus, they propose the use of data mining to provide recommendations to farmers for crops, crop rotation and identification of appropriate fertiliser. They supported the system to be used by farmers on the web, as well on android based mobile devices.

In turn, Barole et al. (2016) evaluating the "AgroHelp" system (a web-based system) that is designed to provide support for advanced farming techniques i.e. use of appropriate fertilisers, providing information and support for pesticides to be used for prevention, as well as solutions to cure the deceases of crops. The authors stated that the information in this system is supported by the database built up using frequently asked questions and respective solutions. It makes use of advanced mining techniques. Therefore, they suggest using this system on mobile phones with internet facilities, as well as on basic phone having SMS support.

Objective of the Study

The broad objective of this study is to find and present the monetary and non-monetary benefits of the on-line fertiliser recommendation system. Its specific objectives are to:

- measure the amount of time saved on average of those farmers receiving on-line fertiliser recommendations.
- determine the amount of money saved on average of those farmers receiving on-line fertiliser recommendations.
- count the number of visits saved on average of those farmers receiving on-line fertiliser recommendations.
- assess the general perception of Online Fertilizer Recommendation System (OFRS) facilities through the on-line fertiliser recommendations system.

Methodology

The proposed study was based upon two types of data — Primary and Secondary.[6] This study has been conducted among those farmers, who receive fertiliser recommendations for cultivation. Most of these interviews were conducted through telephone. In total, 150 telephone interviews took place and a few more face-to-face in the Mymensingh and Tangail districts as a pilot project.

Data Analysis

Data was concurrently entered into the statistical software as it was collected. The data were analysed using SPSS software (IBM, v22). The researchers checked the data's accuracy and integrity by performing a series of frequency and data range checks. Any inconsistencies

[6] Primary data were collected through consultation and Structured Interview. Secondary data were collected from records kept at the regional labs.

were checked visually by comparing the electronic entry to the entry on the original questionnaire.

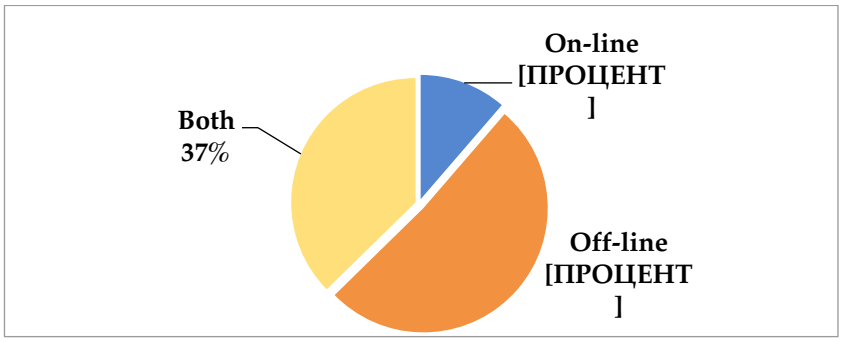
Limitation of the Study

The study's limitation lies with the fact that it was conducted in two districts only – Mymensingh and Tangail. Thus, its results may not be easily generalised for other areas of the country, which differ in terms of location, social and economic conditions, culture, cropping patterns, etc.

Findings of the study

This study was conducted among farmers who already used to receive fertiliser recommendation for cultivation from the Upazilla Agriculture Office and the agricultural officer.

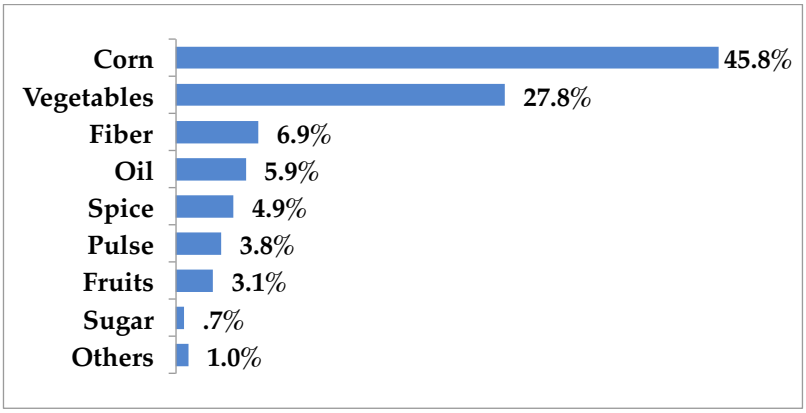
Figure 1: Way of Receiving the Service at present



The findings revealed that 52% of the respondents have been receiving the service of fertiliser recommendation off-line and only 11% on-line. The remaining 37% received the service both off- and on-line. These farmers grow different types of crop such as cereal grain, oil seed, spice, sugar crops etc. The distribution of the crops cultivated are shown in figure 2 below.

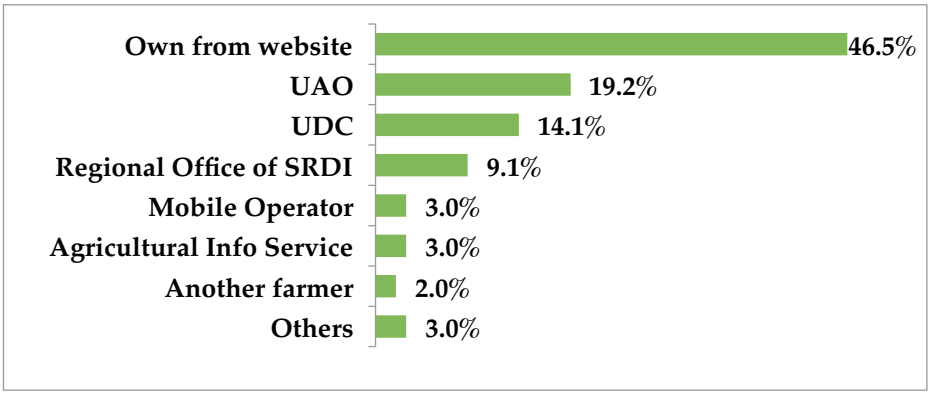
The data reveal that 45.8% of the farmers cultivate the cereal crop maize and 27.8% vegetables. The remainder cultivate fibre (6.9%), oil seed (5.9%), spice (4.9%), pulse (3.8%), fruits (3.1%), and sugar (0.7%).

Figure 2: Types of cultivated crops



During the crop cultivation cycle farmers are confronted with many issues such as fertiliser dosages, pest control, etc. Thus, farmers need specific information on time, otherwise such information is valueless. Figure 3 presents the sources of information farmers use.

Figure 3: Farmers' sources of information

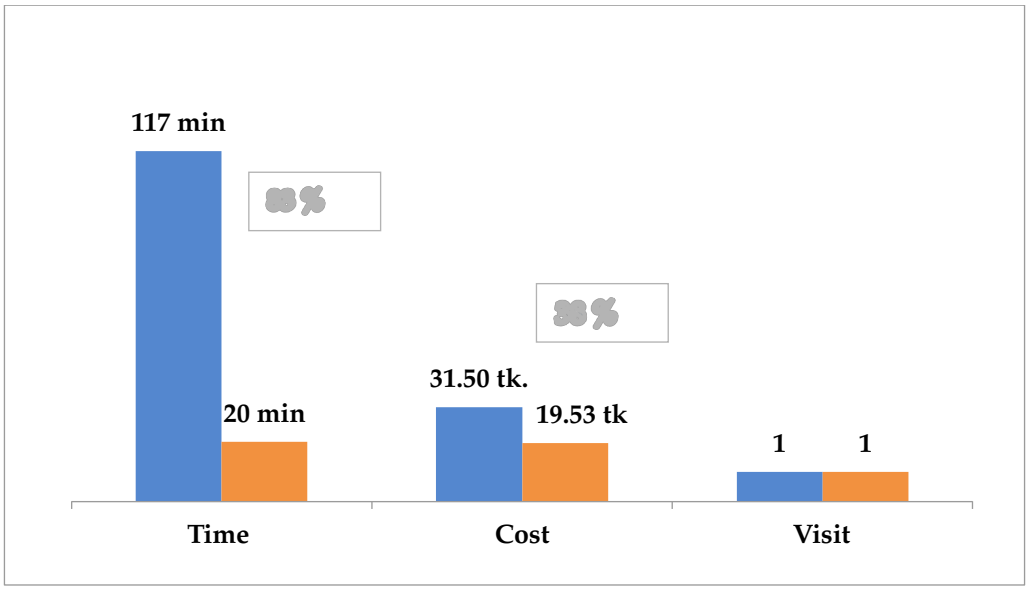


Following the implementation of the on-line fertiliser recommendation service, 46.5% of respondents stated that they received their information from the website. A further 19.2% from the Upazilla agricultural offices and 14.1% from the Union Digital Centre (UDC). The remainder of respondents received their information from the regional office of SRDI (9.1%), through their mobile phones (3.9%), from the agricultural information service (3.0%), through another farmer (2.05) and through other means (3.0%).

TCV Analysis

The TCV analysis provides a comparison between the Time, Cost and Visit elements before and after the introduction of the on-line fertiliser recommendation system.

Figure 4: Average TCV / before and after introduction of on-line system



In the off-line system, a farmer spent an average of 117 minutes to avail this service as compare to 20 minutes needed on the on-line system. Similarly, using the off-line system they had to pay an average of 31.50 Tk as compared to 19.53 Tk using the on-line system. In this context, it seems that the required time was reduced by 83% and the associated costs by 38% on average.

Figure 5 below reveals that 61% of the respondents were of the opinion that the on-line service took less than 15 minutes compared to the off-line system.

Figure 5: Average time required to avail the service – on-line versus off-line

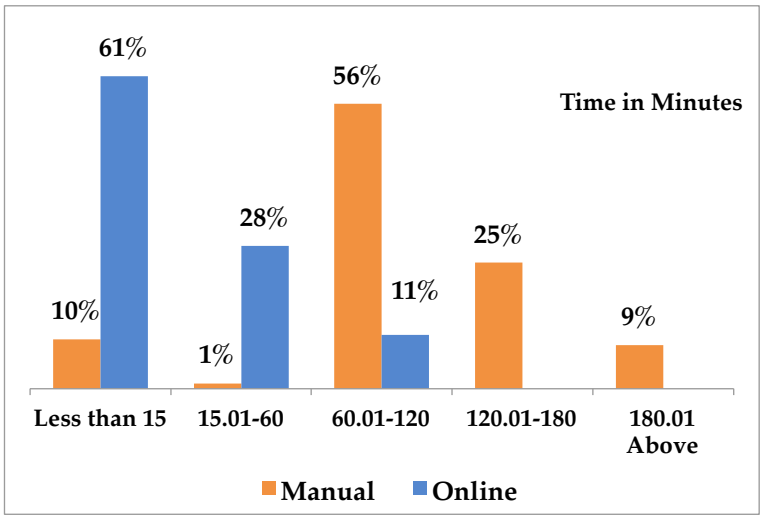
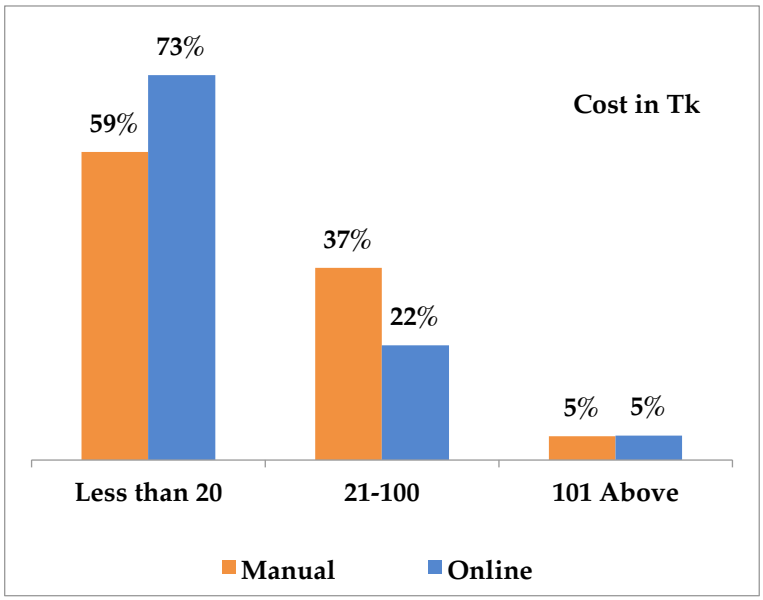
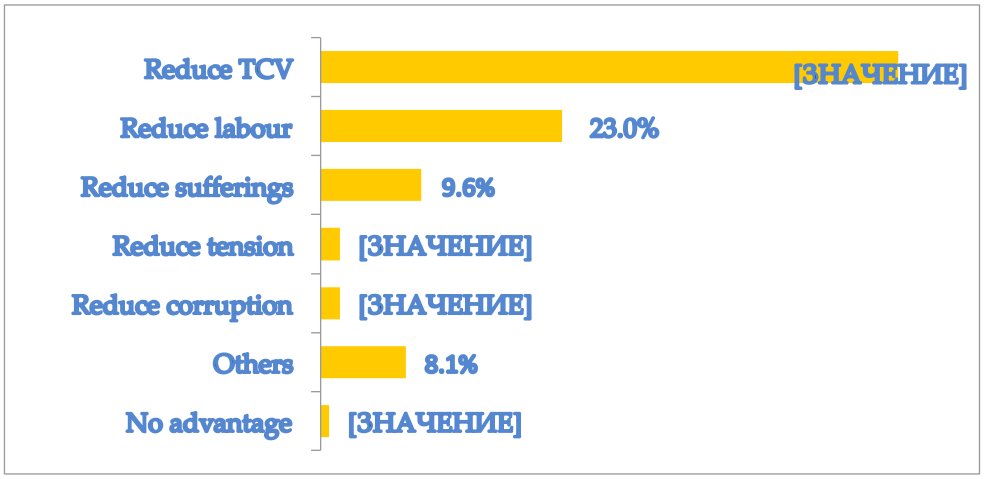


Figure 6: Average cost required to avail the service – on-line versus off-line



Data in figure 6 show that 73% of the respondents spend less than 20 Tk to receive the service on-line, whereas 37% spend over 21 Tk.

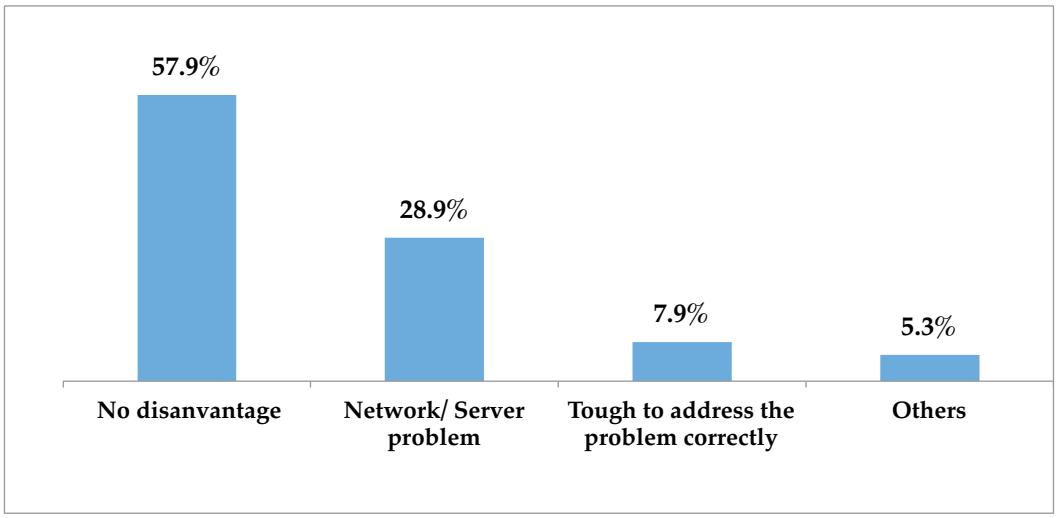
Figure 7: Off-line versus on-line system: advantages and disadvantages



It seems that the advantage of the on-line system is that 54.9% of the respondents said that it saves time and it reduces associated cost, in using the off-line system, farmers can resolve all

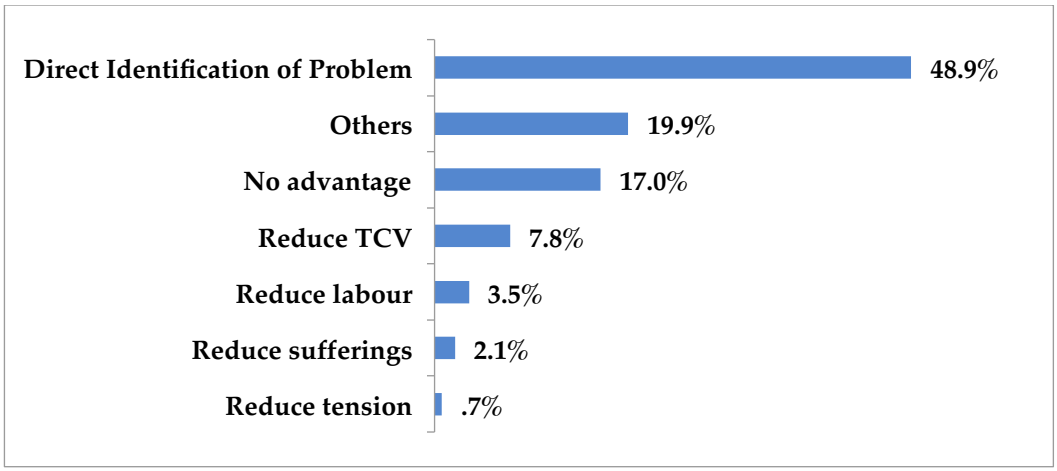
issues directly. However, the on-line system did not help in resolving various issues, something that could be achieved more successfully through the off-line system (face-to-face interaction).

Figure 8: Advantages of Receiving On-line Services



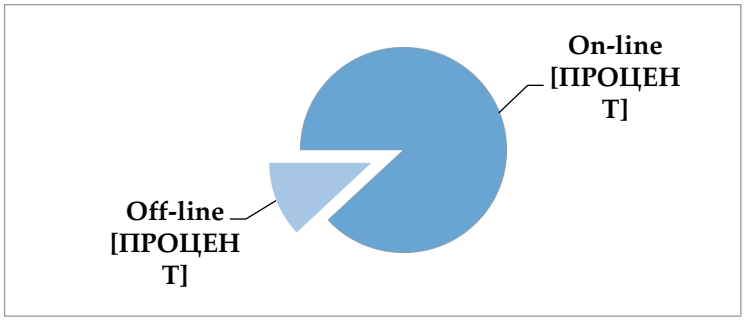
Almost 30% of the respondents also mentioned that network and/or server problems prevented them from using the on-line system successfully.

Figure 9: Disadvantages of Receiving On-line Services



Data in figure 9 reveal that about 48.9% of the respondents mentioned direct identification of a problem was the main advantage of the off-line service. On the other hand, about 17% of the respondents expressed the opinion that the off-line service did not provide any particular advantage.

Figure 10: Preferred modality of the fertiliser recommendation service

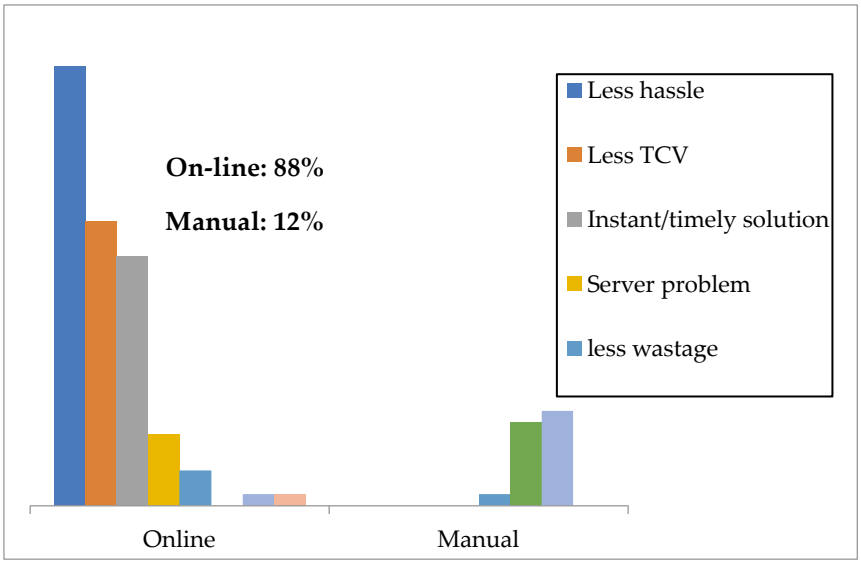


The data in figure 10 show that the on-line service is overwhelmingly preferable when compared with the off-line fertiliser recommendation provision service.

Causes of preferences

The reasons that respondents prefer to use the on-line service are shown graphically in the figure below (No 11). It seems that they prefer the on-line facility because it causes less hassle, it reduced the time and money needed and most importantly, it provides an instant response to their query. Conversely, those who receive the same service off-line said that it provides them with a solution without any ambiguity caused through the use of the on-line system.

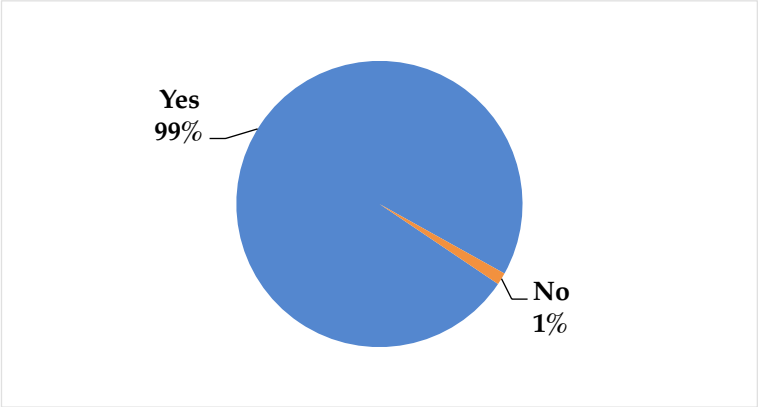
Figure 11: Reasons for preference



A TCV+ Analysis

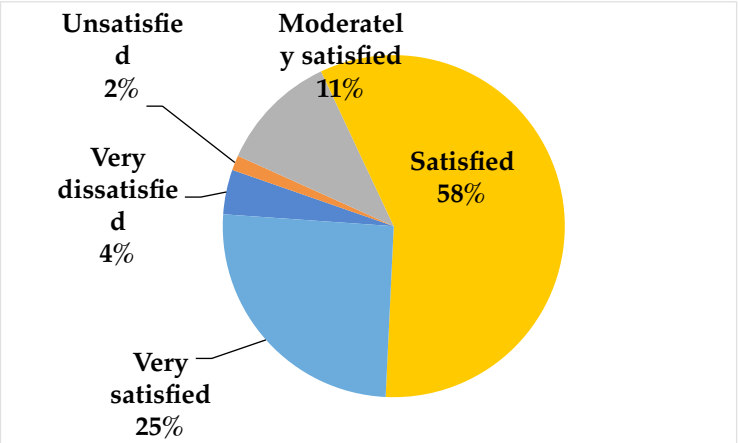
This study has provided a TCV+ analysis of the on-line fertiliser recommendation service focusing not only on the monetary, but also on the non-monetary benefits the system affords. 99% of the respondents said that using the on-line system provided them with the analysis and recommendations results on time.

Figure 12: Percentage of on-line services provided on time



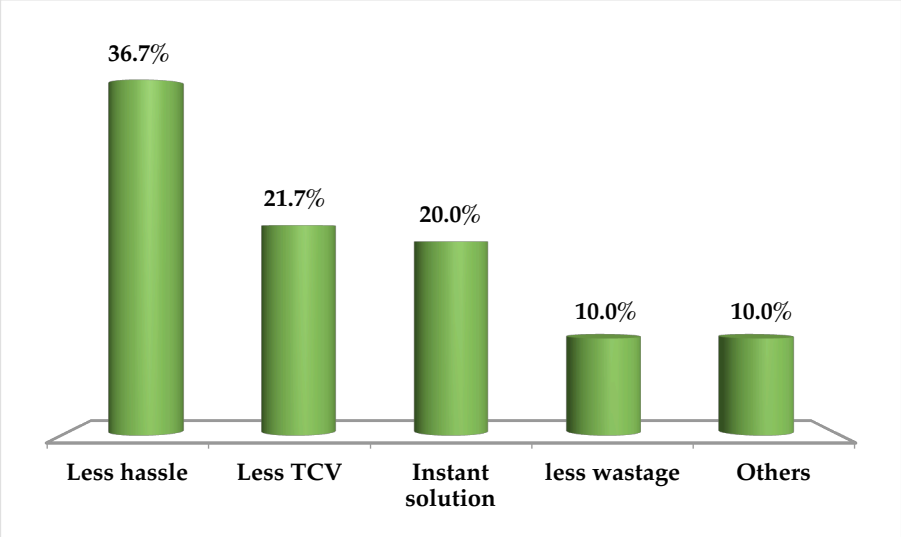
The next figure (No 13) presents the results on the level of satisfaction of respondents using the on-line fertiliser recommendation system.

Figure 13: Level of User Satisfaction



Data in figures 13 and 14 provide the percentage of the respondents' satisfaction level, as well as the reasons for their satisfaction. 58% of the respondents expressed the opinion that they were satisfied and another 25% that they were very satisfied. In this connection, those who were very satisfied and satisfied expressed their views on why they were satisfied. According to their view, the on-line system presented less hassle, it reduced the time and money needed and it provided an instant response to their query.

Figure 14: Reasons for satisfaction



Recommendation

Though the newly introduced service has reduced respondent's time, cost and visits there is still scope for improvement. The following recommendations may contribute in this regard:

- Develop further the internet server and provide easier access to the internet in order to help beneficiaries to get their on-line recommendation more flexibly.
- Create a soil mapping system based on the geographical mapping, in order to determine soil type easily according to the particular area.
- Continue to disseminate widely the UDC services and its activities throughout the country.
- Increase the UDC's volunteer base and its manpower in order to ensure continuation of the UDC service.

Conclusion

The on-line fertiliser recommendation system has provided an easy and quick way to access fertiliser recommendation. This newly introduced service has reduced the time, cost and number of visits of beneficiaries. It has also demonstrated an alternative scenario about service delivery. This web-based fertiliser recommendation system is now available to farmers through the use of digital technology. The automation of the system will contribute to yielding a higher crop production, much needed for Bangladesh, as well as protect farming soil from contamination due to reasonable use of fertilisers in the production process.

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