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KNOWLEDGE MANAGEMENT BY WOMEN FOR CLIMATE CHANGE ADAPTATION IN AGRICULTURE

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ABSTRACT

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Bangladesh is one of the most vulnerable countries to climate change. Changes in rainfall pattern and intensity of extreme events are evident. Due to the male migration caused by climate change and development drive there occurs huge feminization in agriculture. The perception and impact of climate change is completely gender differentiated; women are seemed to be disproportionately affected by climate change. Moreover, to cope with the climate change the community is now cultivating new crops and varieties. Besides, they are using different new cultivation methods and techniques to adapt with climate change. For newly introduced crops the traditional knowledge is not sufficient. Use of mobile phones for knowledge and information sharing in agriculture is gaining popularity among farmers. Growing interest on climate change adaptive agriculture among the female farmers and easy availability of mobile phones and network service created an opportunity of knowledge management on adaptive agriculture. The mobile phone use efficiency and ICT self-efficacy among the rural women are significant. The decision-making capacity of women is limited and there are number of challenges though the farming responsibility is gradually shifting towards them. The study was conducted in the Charland of Nilphamari District of Bangladesh from June 2017 to December 2019 to know the scopes and requirements of adaptation knowledge management in agriculture.

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INTRODUCTION

Bangladesh is one of the most vulnerable countries to climate change. There are evident changes in extreme weather events like rainfall pattern and seasonality (Islam and Kotari, 2016). The livelihood and income of a large population of the country depends on the natural resource base and most of the poor people often live in marginalized lands and areas are more prone to natural disasters. Climate change means that many natural disaster-prone areas will become more prone due to increased frequency and intensity of disasters (Hossain, 2012). It is necessary for farmers to take measures to reduce and manage climate change risk by ensuring intergenerational equity and sustainable development (Islam and Nursey-Bray, 2017); adaptation is necessary to reduce this vulnerability (Stern, 20017) and adaptation can successfully reduce negative impact by enhancing positive outcome in crop production amongst other responses (Wheeler *et al.*, 2013). Government and development organizations in Bangladesh have been introduced number of adaptation technologies which includes new species and varieties of crops and cultivation practices to cope with the climate change.

Due to climate change women are disproportionately affected, at the same time they play a crucial role in climate change adaptation and mitigation actions. Women have developed a large number of strategies to deal with the changing climate conditions. These are generally coping strategies and not adaptation strategies, as the women are reacting to changes the best they can. Adaptation strategies, however, require an additional thinking ahead and planning of measures to improve the adaptive capacity of women based on already existing capacities. In coping with the changing conditions, women are relying on their local knowledge (Akeba *et al.*, 2012). For the new crops and new cultivation techniques local knowledge is not always sufficient. There is significant requirement of new knowledge for the new cultivation practices.

Towards the knowledge management on adaptation to climate change in agriculture the use of Information and Communication Technology (ICT) can play a very important role. Use of information technology is easy and cost-effective in knowledge management, but there are number of challenges too. The main barriers of ICT in agriculture are modern technologies adaptation, unskilled person for operating, inadequate farmer knowledge, lack of infrastructure, lack of financial support, lack of technical support, lack of innovation, lack of research, etc. (Rahman, 2016). There are indirect benefits of ICT in empowering farmer are significant and remain to be exploited (Roshidul, 2016). Among the information technologies the use of mobile phone is very common by the farmers. The device mobile phone set is now containing many functions; it is no more a talking device only. During the field observations it was also found that the engagement of women in agriculture both in field cropping and homestead gardening has been increasing. This paper aims to articulate the role of mobile phone device as an ICT tool in knowledge management in coping with the climate change in agriculture by the women farmers.

METHODOLOGY

The study on the scope of using ICT specifically the mobile phone on knowledge management in agriculture by women was conducted in the village Daskhin Kharibari of Dimla sub-district under the Nilphamari district from June 2017 to December 2019. Charland is a sandy land on riverbank or Riverine Island formed by the sedimentation of the river and usually is less fertile. There was a development intervention in this village namely PROTIC, implemented by development organizations Oxfam, Pollisree, Monash University, Melbourne and Hajee Mohammad Danesh Science and Technology University, Dinajpur and some universities and private companies for the empowerment of women farmers by using ICT. This action research project has trained 100 women on using the participatory action research tools; those trained women are called animators of that action research project.

The current study has interviewed the animators to know the climate change impact and mobile phone use efficiency; though the interview targeted covering all the 100 trained research animators of the project, but during the assessment only 85 individuals were covered while others were not available in the village then. To understand the prospective of the gross community consultations were conducted where there was presence of both project trained women farmers and male and female farmers who were not project beneficiaries; 4 community consultations were conducted. The consultations were in small group of 8 to 10 individuals

supported with targeted questions but in a form of storytelling by the participants. Three out of 4 consultations were with women only; one was in a mixed group. In the study total 40 female farmers and 6 male farmers were consulted among them 20 were not the project beneficiaries.

The use pattern of the mobile phone was assessed by following the Mobile Phone Use Index (MPUI) formula. Use of mobile phone for climate change adaptation taken by the women farmers was measured by using three points rating scale as 'regularly', 'occasionally', and 'not at all' and weights were assigned to these responses as 2, 1, and 0 respectively. The following formula was used for this purpose:

$$\text{MPUI} = N_1 \times 2 + N_2 \times 1 + N_3 \times 0.$$

Where,

MPUI = Mobile Phone Use Index;

N_1 = Number of women who use mobile phone regularly;

N_2 = Number of women who use mobile phone occasionally;

N_3 = Number of women who use mobile phone not at all;

RESULTS

Climate change vulnerability and threats to the livelihoods

Climate change is evident in the Charland of Dimla. The community can identify the changes happened over time on the weather and hazards. The community consultations have identified the changes in occurrences of hazards and their impacts.

Hazards

The community has expressed their experience about the changes in the rainfall pattern and the intensity of extreme weather event. There was a significant demarcation identified by the community on the extreme weather events that is noted in the Table 1. To identify the impact level of climate related hazards on the daily life of female farmers, open-ended questions were kept in the interview schedule. Flood (94.1%) emerged as the most devastating and frequently occurred hazard due to climate change, expressed by the women farmers. Flood is most frequently occurring event and considered to be the main hazard in this area. Table 2 ranked the order of hazards following the intensity of suffering of the women farmers from the occurrence. Drought is very localized and scattered musically, even a few square meter areas in the crop field was suffering from heavy drought. Hail storm incidence has been increased. The least (17.6%) perceived hazard occurred due to climate change mentioned by the women farmer was 'Heavy fog'. Heavy fog sometimes hampered their agricultural activities; the winter vegetable saplings are suffering.

Table 1. State of the extreme weather events at Dimla due to climate change

| Weather events | Changes comparing with the past 10 years | State |
|----------------|--|--|
| Flooding | Intensity and frequency increased | Current flooding is more frequent. In almost every year there is flooding. Earlier there was significant gap between high water levels flooding but currently the gap become very short. |
| Extreme heat | Intensity increased | Though there are not that many changes in the period of days with high temperature but nowadays, the feeling temperature is too high. |
| Extreme cold | Exists for very short period | Only a few days in winter season are extreme cold now. For last few years it is not more than a week, but the cold weather existed for around a month. |
| Fog | Pattern has changed | There were only a few foggy days earlier, it was for around a week in winter, but now the fog is stripe like and very dense and lasts for few hours. Heavy fog during night time exists for 3 to 4 days. |
| Thunder storm | A new hazard occurring | It was very rare incident earlier, but very common now. |
| Heavy Rainfall | Fast heavy shower | The pattern of rainfall has been shifted totally. Now there occurs a heavy raining in a very short time. |

Table 2. Rank order of the natural hazards frequently occurred at Dimla due to climate change

| Natural hazards | No. of citation | Percent (%) | Rank order |
|-----------------|-----------------|-------------|-----------------|
| Flood | 80 | 94.1 | 1 st |
| Drought | 75 | 88.2 | 2 nd |
| Hail storm | 37 | 43.5 | 3 rd |
| Heavy rainfall | 25 | 29.4 | 4 th |
| Storm | 22 | 25.9 | 5 th |
| River erosion | 17 | 20.0 | 6 th |
| Heavy fog | 15 | 17.6 | 7 th |

Impact of climate change

Women have the care work responsibly in their family. They have to manage from cooking to health care of every family member. Moreover, due to the migration of the male members of the family the farm work is an added burden to them. Though crop processing after harvesting and preservation were done by women, but nowadays, woman has to take part in field preparation and cultivation too. Changes in the extreme events added more responsibilities during disasters and recovery period. The major challenges noted by the women were as of Table 3. The above-mentioned additional work burden is consuming their time of everyday life. The assumed time burden due to the climate related hazards noted by the women of the community during the community consultation was calculated as below in Table 4.

Table 3. Burden to women from the climate induced hazards

| Natural hazards | Additional burden |
|-----------------|--|
| Flood | Protection of the homestead from water and flooded garbage, specifically the waste from latrine and cow dung from the cattle house; Saving home from snakes and insets; Saving children from drowning; Managing fuel for cooking and arranging food. |
| Drought | Irrigation, in most cases watering by hand. Water needs to be collected from river and for that women have to walk up to the bottom of the river with bucket. |
| Heavy rainfall | Ensuring drainage for water pass from yard and crop field; minimizing risk of diseases of family members; Ensuring the fuel wood for cooking; Drying cloths using alternative ways. |
| Storm | Protecting house and crops; Reconstruction of houses; Keeping privacy is a challenge. |
| River erosion | Minimizing the risk of displacement; Shifting the houses to other places; Sexual violence while living in a temporary shelter or new locations; Managing flood for the displaced family members. |
| Heavy fog | Covering the crops, mostly for the winter vegetables and also removing the cover on time. |

Table 4. Additional time burden of women due to the climate induced hazards

| Natural hazards | Days in a year (average) | Hours in days (average) |
|-----------------|--------------------------|-------------------------|
| Flood | 12 | 4 |
| Drought | 20 | 2 |
| Heavy rainfall | 6 | 1.5 |
| Storm | 10 | 1 |
| River erosion | | Whole day |
| Heavy fog | 5 | 3 |

Traditional knowledge in Agriculture

Community has its own traditional knowledge of farming. The agrarian community has wider knowledge on local agriculture. It was found that both autonomous and planned adaptation on the current practices of cropping in the community at Daskhin Kharibari village were mostly from traditional knowledge expect selection of crop species and varieties. Use of machineries is gradually increasing. However, nowadays traditional knowledge in farming is not enough as cultivating new crops requires new knowledge. Adaptation intervention has introduced many practices on which local community in some extent has no knowledge. For example, maize which was not a local crop but very widely cultivated requires updated knowledge about it during cultivation. The knowledge transfer mechanism that was followed in an agrarian community was found interrupted due to the male migration, i.e., climate change has impacted the flow of traditional knowledge transfer from generation to generation. Moreover, though the traditional knowledge transfer from male farmer to male framers exists in a very low state but the need of transferring traditional knowledge from male farmers to female farmers is nearly non-existing. During the community consultations the gap of knowledge were reported in every stages of framing from crop selection to marketing.

Modern technology for knowledge management:

For the knowledge management on the adaptation in crop farming, ICT can play a very important role. In Bangladesh, because of the culture there are some limitations on the mobility of a woman. It was found that in a Charland community, where literacy rate is low and strong kinship among inhibitors are prominent, the longest distance a woman covers in a regular day was only 2 km. So, the information that reaches up to that distance can aware the community. In this case, the ICT can solve the problem. Different development interventions were being taken by Government and Non-Government Organizations for this purpose. The current study has found such a development project PROTIC has been facilitating the women in using the mobile phone, the project learning is being also benefiting the wider community including the female farmers who are not project beneficiaries and also the neighboring communities of the project area. The use capacity of the mobile phone by the community was as follows:

Use efficiency of mobile phone for climate change adaptation of the women farmers

Women in the village Daskhin Kharibari from the support of the project PROTIC has been using the mobile phone. Though they were oriented on using the mobile phone set, but the use efficacy was not found as expectation for climate change adaptation even after a year of using. Data furnished in the Table 5 reveal that 64.7% of the women farmers had medium use of mobile phone for climate change adaptation while 29.4 % had low and only 5.9 % had high use of mobile phone for climate change adaptation. The average mean value of the use of mobile phone for climate change adaptation indicates that the women farmers in average had medium use of mobile phone for climate change adaptation. The finding clearly indicates the unawareness of the respondents about the use of mobile phone in climate change adaptation. Lack of interest and responsiveness had found in using mobile phone for receiving climate change adaptation techniques related information. Most of the women farmers preferred mobile phone for communicating with their family members, neighbors and relatives. Therefore, it is necessary to encourage the women farmers in receiving climate change adaptation information regarding crop variety, crop change, and other climate change adaptation technique through mobile phone.

ICT Self-efficacy

The scores for ICT self-efficacy by the women farmers ranged from 1 to 28 with an average of 15.73 and a standard deviation of 6.93. Based on the ICT self-efficacy, the women farmers were classified into three categories such as 'low' (≤ 11), 'medium' (12-22) and 'high' (> 22). The distribution of the women farmers according to their ICT self-efficacy is shown in Table 6. The findings specified that slightly above half (51.8%) of the women farmers have medium ICT self-efficacy, while 28.2 % have low ICT self-efficacy and 20.0 % have high ICT self-efficacy. Findings revealed that 80.0 % of the women farmers had low to medium ICT self-efficacy.

Knowledge in Application

Though the project intervention has given the information to the female farmers, but the application of learning is not that easy by the women in a patriarchic society. Major barriers identified by the community were as follows:

- Managing time: Time management by women is a serious concern. After addressing all the household works, time for planning on adaptive farming was not sufficient. Moreover, decision making requires convincing the family members, and also fair from the social norms.
- Ownership (on device, crop and land, etc.): In Bangladesh the land tenure is the major challenge for women farmer for selecting crops. Now women have nearly no rights on the land specifically on in the inherent lands. The crop selection is dominated by male only; it only differs for women headed families.
- Scope of enjoying the new knowledge: It was found that knowing about new technologies was not always enjoyed by the women. Women with more family responsibilities were found less enthusiastic and not enjoying this.
- Right to decide: Till the right of decision-making is by male members only.

DISCUSSION

Climate change is resulting feminization in agriculture, male migration to cities as informal workers, rickshaw puller etc. and forcing women to take responsibilities of farming. Climate change is adding additional work burden to the life and livelihoods and amplifying the vulnerability of the rural community. The Bangladesh Environment and Climate Change Outlook 2012 (DoE 2013) stated that, "Climate change is generating adverse environmental, economic, social and human consequences in Bangladesh. Vulnerability to changes in temperature, rainfall, flood regime, storm surge and drought poses serious threats to the economic development of Bangladesh. Those vulnerabilities hinder the agriculture production systems, economic and social development through two processes: first, by damaging the crops, livestock, fisheries and agro-forestry, natural resources and infrastructure, and the second, in hindering the on-going development, business and trade at local, regional and global level." Climate change is likely to adversely affect women more than men (MoEF, 2008); Among the poor people women are seemed to be disproportionately affected by climate change (Tanny and Rahman, 2016) and in this study it was found that the work load sharing in agriculture was adding more vulnerabilities to the women. Women are also more vulnerable to the effects of climate change than men, because the socially constructed roles and responsibilities they have within communities and the differentiated power relations make them more disadvantaged (Nellemann *et al.*, 2011; Ribeiro and Chaúque, 2010). Similar findings came out from the community consultations too. Though the women in the villages act as knowledge hub of the community, the discussion making for crop selection and other management was by the male members of the family though they are absentee. The perception and impact of climate change is completely gender differentiated. Women are ever more vulnerable to the impact of climate change than men, because they have very limited access to financial resources, land, education, health services and in decision making process. All these insufficiencies make women vulnerable to climate induced disaster than men (Mondal, 2014). The impending impacts of climate change particularly the increasing frequency and intensity of extreme climatic events affecting agriculture, water resources and the livelihoods of poor women not only impede the development activities, but also exerts direct vulnerability to women (MoEF, 2013). Woman has to take the work load of farming as well as disaster management in the crop field. The extreme events due to climate change are resulting more hazards in the crop field. The thunderstorm was recorded as a very new hazard to the crop field of the Titsa Floodplain. New varieties and species of crops and new form of cultivations are also challenging for the female farmers as new knowledge is required for them. This argument is supported by previous researches too. Roy and Venema (2002) argue that the ability of women to adapt to climate change pressures will be enhanced by using the 'capabilities approach' to direct development efforts. By using this approach, women will improve their well-being, and act more readily as agents of change within their communities. This study also noted significant capacity of women in using the mobile phone and also recorded a sound self-efficiency. ICT serves two broad functions: it enables communication and serves to process and store information for future reference (IICD, 2014). One of the key ways in which mobile technology is working to improve the efficiency of the agricultural sector is by improving the accessibility and

availability of real time information to farmers. Information transfer can be bi-directional: helping farmers obtain information and provide information services to offer different levels and quality of information. This can range from agricultural tips and advice to best farming practices. Services sometimes have the option for service providers and producers to link with one another creating networks (CLP, 2014). Hasan *et al.*, (2009) has concluded in a study: as the vast majority of poor people live in rural areas and derive their livelihoods directly or indirectly from agriculture, support for farming should be a high priority for upcoming and existing information centres initiatives in Bangladesh. The centre needs to deliver useful information to the farmers in every aspects of farming including crop care and animal husbandry, fertilizer and feedstock inputs, droughts mitigation, pest control, irrigation, weather forecasting, seed sourcing and market prices etc. The information disseminated by e-agriculture can be divided into several major areas such as: weather information, production and cultivation techniques, diseases and insect information, price information, etc. (Kashem *et al.*, 2010). Roy (2013) has rightly noted in his research that becoming economically independent through the help of ICT the rural women also keep a great contribution in the economy of our country. But it's true that contribution of women in agriculture is yet to be broadly recognized. Provided information should be reliable and upgraded regularly (Rajendran, 2014) and need to be considered seriously by every stakeholder as the scope of ICT is flourishing very rapidly.

The International Centre for Integrated Mountain Development (ICIMOD) has a very successful example of using information technology for the knowledge management of mountain range of Himalayan Hindukush (ICIMOD, 2011). There is no evidence that Knowledge Management, in all these respects, is any different from other management initiatives (Applegate *et al.*, 1988). According to Lueg (2001), knowledge is often seen as information, with specific properties, which is viewed as a kind of preliminary stage to knowledge. This relationship of information and knowledge allows the application of computer-based information management techniques, such as information retrieval and information filtering, to the management of knowledge. The knowledge creation process involves the searching of new implemented knowledge and information, both indoor and outdoor of the organizations that developed through collaboration and partnership (Chen and Edgington, 2005).

The role of women in agriculture has been changed due to climate change. Women are playing different roles in their families. But, access to service from different service providers is still far reaching for women. Therefore, mainstreaming the gender in policies and development process is very urgent (Mondal, 2014). For the knowledge management on adaptation in agriculture by the female farmers facilitation from both policy and practice is necessary. Moreover, academics, business community and the development community can also play a vital role in supporting the women facing that new challenge.

CONCLUSION

To cope with the current state of climate change adaptation to crop farming is a must, and feminization in agriculture is a fact. In this context knowledge management for adaptation is vital requirement and definitely women are the target community. The information technology is probably the most appropriate means of communication. Application of the knowledge requires enabling environment. The community skill on ICT use can make the knowledge transfer process easy. The knowledge management process using the ICT can minimize the risk of isolation and compartmentation of the components of different interventions. The remote communities can have great opportunities of entering in the knowledge era by the women. There are emerging challenges from climate change too. Knowledge management in adaptation to climate change in agriculture is an urgent and unremitting requirement; ICT can pay the most effective role on it.

COMPETING INTEREST

The all the authors agreed that they have no conflict of interests exists.

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REFERENCES

1. Abeka S, S Anwer, V Bhatt, S Bii, BP Muasya, AR Rozario, G Valverde and OAV Vilchez, 2012. Women Farmers Adapting to Climate Change [Women Farmers/ Climate Change: Duologue 9]. Brot für die Welt, Germany.
2. Applegate L, J Cash and DQ Mills, 1988. Information technology and tomorrow's manager. In McGowan, W.G. (Ed.) Revolution in Real Time: Managing Information Technology in the 1990s. Boston MA: Harvard Business School Press, 33-48.
3. Chen A and T Edgington, 2005. Assessing Value in Organizational Knowledge Creation: Considerations for Knowledge Workers. MIS Quarterly, 29 (2).
4. CLP, 2014. The use of mobile technology and its application in CLP-2, Char Livelihood Program, Dhaka.
5. DoE, 2013. Bangladesh Environment and Climate Change Outlook 2012. Department of Environment, Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh. xxii+138 pp.
6. Hasan R, S Islam, MS Rahman and KNA Jewel, 2009. Farmers Access to Information for Agricultural Development in Bangladesh. Bangladesh Research Publications Journal 2 (1): 319-331.
7. Hossain MA, MR Imran, S Rahman and I Kayes, 2012. Climate Change and its Impacts on the Livelihoods of the Vulnerable People in the Southwestern Coastal Zone in Bangladesh. In: Leal Filho W (eds) Climate Change and the Sustainable Use of Water Resources. Climate Change Management. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-22266-5_15.
8. ICIMOD, 2011. Sustainable Mountain Development No. 58, International Centre for Integrated Mountain Development (ICIMOD), Spring 2011.
9. IICD, 2014. ICT for livelihoods, International Institute for Communication and Development (IICD), Hague, the Netherlands.
10. Islam M and K Kotani, 2016. Changing seasonality in Bangladesh. Regional Environmental Change 16, 585–590. <https://doi.org/10.1007/s10113-015-0758-5>.
11. Islam TM and M Nursey-Bray, 2017. Adaptation to climate change in agriculture in Bangladesh: The role of formal Institution. Journal of Environmental Management. 2000 (2017) 347-358.
12. Kashem MA, MAA Al-Farouque, GMF Ahmed and SE Bilkis, 2010. The complimentary roles of information and communication technology in Bangladesh Agriculture. Journal Science Foundation, 1 & 2(8):161-69.
13. Lueg C, 2001. Information, knowledge, and networked minds. Journal of Knowledge Management, 5(2):151-160.
14. MoEF, 2008. Bangladesh Climate Change Strategy and Action Plan 2008. Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh. xvi + 68 pp.
15. MoEF, 2013. Bangladesh Climate Change and Gender Action Plan. Ministry of Environment of Forest, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh. xvi+122 pp.
16. Mondal MSH, 2014. Women's Vulnerabilities due to the Impact of Climate Change: Case from Satkhira Region of Bangladesh. Global Journal of HUMAN-SOCIAL SCIENCE: B Geography, Geo-Sciences, Environmental Disaster Management. 4 (5).
17. Nellemann C, R Verma and L Hislop, 2011. Women at the frontline of climate change: Gender risks and hopes. A Rapid Response Assessment. United Nations Environment Programme, GRID-Arendal.
18. Rahman T, 2016. The potential of ICT for Agriculture in Bangladesh. <https://europe.ypard.net/2016-may-15/potential-ict-agriculture-bangladesh#> (accessed 16 Feb 2020).
19. Rajendran V, MH Hossain, Gopinath and Veronica, 2014. ICT based Young Rural Women Entrepreneurs Programme in India Based on the Best Practice in Bangladesh. CIRDAP-RGNIYD.

20. Ribeiro N and A Chaúque, 2010. Gender and Climate change: Mozambique Case Study. Heinrich Böll Foundation Southern Africa, 42 p.
21. Roshidul H, MA Haque and TR Chakraborty, 2016. The Potential of Local Language based Mobile App in the Norther Part of Bangladesh for Maize. International Journal for Research and Development in Technology. 6 (5): 233-238.
22. Roy M and HD Venema, 2002. Reducing Risk and Vulnerability to Climate Change in India: The Capabilities Approach. Gender and Development Vol. 10, No. 2, Climate Change (Jul., 2002), pp. 78-83, Taylor & Francis, Ltd.
23. Roy M, 2013. Pragmatic Approaches to Sustainable Development through Rural Women Empowerment in Bangladesh. Journal of Economics and Sustainable Development, 4 (10):1-8
24. Stern NH, 2007. The Economics of Climate Change: the Stern Review. Cambridge University press. Cambridge, UK
25. Tanny NZ and MW Rahman, 2016. Climate Change Vulnerabilities of Woman in Bangladesh. The Agriculturists 14 (2): 113-123
26. Wheeler S, A Zuo and H Bjornlund, 2013. Farmers' climate change beliefs and adaptation strategies for a water scarce future in Australia. Global Environmental Change, 23 (2): 537-574.