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Performance Measurement Model for Agriculture Extension Services for Sustainable Livelihood of the Farmers: Evidences from India

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Abstract

Extensive services to agriculture are continuously evolving in less-developed economies like India. With a focus on productivity and farmers' livelihood improvement, Indian agriculture sector has witness a wide range of reforms in past decades. However, the unsustainable, fragmented and decentralized approach has attracted nationwide debate and criticism about the effectiveness of these reforms. In this study, empirically at the micro level, we investigated the impact of the government reforms and initiatives to address current challenges of agricultural extension services in India. We firstly identified the gap between the required demand of small and marginalized farmers from the public extension services and the services supplied to them. Further, based on the identified supply-demand interface, we develop the performance measurement metrics to derive the famers' satisfaction level. This study considered many factors which may be predictors of farmers' requirement from the extension providers. We attempted to understand the interplay of those factors using correlation and factor analysis and then using ordinal logistic regression we regressed the constructs with the farmers' requirement indicator variable to the satisfaction level to derive package appropriateness factors. The farmers' perception of the service parameters are then used within the model to figure out gaps in the requirement of farmers and the services being provided to them by the government organizations within Meghalaya, a State of India.

Keywords

Agriculture Extension Services, Farmer's Satisfaction, Performance Measurement, Perception, India

1. Introduction

Performance of agriculture sector depends upon its ability to cope with the contemporary challenges like rising population, changing demand pattern of food and agri product, climate change, resource scarcity and many more uncertainties. The sustainable livelihood and quality of life of rural population is consistently linked to the performance of agriculture sector. Agriculture Extension services, as an important development intervention, focuses on increasing the growth potential of agriculture sector and promote sustainable, inclusive and pro-poor agriculture development and hence economic development.

Since 1990, Indian extension system has expressed major changes in governing structure, capacity organisation and management, advising method, etc. [1]. The prime impetus of these initiatives is to reverse the consistent fragmentation of supportive cultural/social structures and the negligence to the technically and economically defied ones. The farmers, predominantly under the rural or tribal setting are often devoid of supplies of rich Physical, Social, Economic, and Technological resources. They are forced to struggle on a daily basis to survive and are unable to cope with any additional stress factors like population growth and abject poverty [2]. It is necessary to empower the farmer community, especially the socially and economically excluded, with the right to monitor all reforms, schemes and programs as owners and participants of all development and governance processes in their areas of residence.

While the development of technology and focused research has supported the green revolution and modernization of agriculture, the farmers merely stand as receivers, and remain distant from the agronomist and extension workers. This assortment and asymmetric inclusion of farmers is a big concern. There are large gaps in research and unanswered questions on the role of agricultural extension approaches from the perspective of farmer side demand. There is a need to re-look the challenges in front of public extension services from the holistic systems perspective to create a demand-driven and farmer accountable extension.

The objective of the study is to evaluate existing public extension services in India by assessing the gap between the required demand of farmers and the extension services supplied to them. Referring to the supply chain literature, a push-pull system defines the flow of a product or information between two links of a network. In this context, we are referring, consumers (farmers) usually "pull" the goods or information they demand for their needs, while the suppliers (Extension worker) "push" them toward the consumers based on the expected demand. The interface between these stages is called the Push-Pull Boundary as a strategic fit between the push and pull reform approaches. In this study we considered factors as predictors of farmers' satisfaction from the extension providers. Further we tried to understand the interplay of those factors using factor analysis and then regressed the components derived from the factor analysis with the farmers' satisfaction indicator variable—Satisfaction level to derive package appropriateness factors. These factors, mainly farmers' perception of the

service parameters are used within the model to figure out gaps in the requirement of farmers and the services being provided to them by the government organizations. At the time when services are the key domain for the farmers' productivity and livelihood improvement, these findings will be immensely helpful for developing strategies and hitting the root causes responsible for inefficient and weak extension services in India.

In this study we kept Meghalaya, the North Eastern State of India as the scope of investigation. The economy of Meghalaya is agrarian in nature as it is rural based with agriculture occupy a principal share in the state's economy. About 81% of the state's population depends on agriculture. The employment and income generation also depends on agricultural developmental activities to a great extent. We start our analysis by conducting an in-depth study to access the present situation of agricultural extension services in Meghalaya. This help to identify the potential gaps and the need for change. In the next section, after presenting the critical literature review, we present the conceptual framework to establish the theoretical linkage between the Demand of the farmers and Supply of the services received by the farmers within the larger framework of sustainable livelihood and pro-poor development. Next, we discuss the empirical results and the model depicting famer satisfaction. This includes a thorough analysis of various issues linked with extension services from farmer side production to customer side consumption, including subsidy, cost, price fluctuation, transportation, storage, agriculture trade, etc. The last section discusses the managerial implication with the concluding remarks.

2. Literature Review

Agriculture extension or advisory services comprises of set of organization that strengthens the pliability of individual and community engaged in agriculture activities by providing them an opportunity by increasing their access to tangible and intangible resources, such as input and knowledge [3] [4] [5] [6]. The extension services in India, mostly publically driven, facilitate farm households with scientific, technical, marketing and administrative information for a better decision making along the agri-supply chain. Available literature shows that agricultural extension in India is now seen playing a vital role in agri-supply chain like, developing human and social capital, enhancing knowledge and skill for better productivity and profitability, information processing and dissemination, facilitation and access to market, and working with farmers for their long term sustainable development [6]-[12]. With broad role and required breadth of facilitation and information support the extension services became resource intensive.

As per the NASSO 2013 survey the coverage of agricultural extension in India, is inadequate. Government extension programs, extension services of the national agricultural research system, cooperatives, and nongovernmental extension programs have a very limited outreach [13]. The survey could be considered old enough to mention, but the research in following years also suggest that situa-

tion is not significantly changed [3] [6]-[12] [14] [15] [16].

Raabe reviews agricultural extension approaches in India by considering supply-side and demand-side reform aspects [17]. Demand-side aspects explored were governance structures, capacity development, and affirmative action. Supply-side aspects addressed included administrative and fiscal decentralization, private- and third-sector involvement, capacity development, and information and communication technology (ICT) use. Glendenning [4], with their analytical framework, pursue to explain the innovative extension approach with focus on governance structure, capacity and management, nature of local communities, and consequent performance and impact. Both the aforementioned studies consider demand-driven and inclusive approaches as an important aspect of improving agricultural extension provision to increase accountability and transparency in agri-chain performance. In his number of articles written on agricultural extension in India, Sulaiman, mentions the innovation systems concept to describe the weaknesses in public- or private-sector extension programs and provide suggestions for strengthening the systems [18] [19] [20].

As the agriculture system become more complex, to remain competitive, famers need reliable, timely and relevant information inputs. In addition, given relatively less literacy level of farmer communities, the delivery mode of the information must be in the manner they prefer and understand [21]. Literature suggest that farmers need a breadth of information appropriate technology, optimal use of inputs, changing farm system options, input suppliers, intermediaries, quality specification, market and trade, time to buy inputs and sell produce, off farm generation options, implication of changing policy access to credit and loans etc. [22]-[31]. The information required differ between categories of farmer, geography, land holding size, etc. Sammadar [32] states that context specific information has higher impact on adoption of technologies and positive influence on productivity on smaller and marginalized farmers. Lele [33] states the challenges Indian farmers confront like limited land and water availability; climate changes; changes in demand and consumption patterns, moving toward high-value agriculture; increasing population pressure; and liberalization of trade. These challenges have brought down the competiveness of the small and marginalized farmers to their lowest level of existence.

The increasing penetration of mobile telephony in rural and urban India presents an opportunity to make relevant information more widely available. This could help agricultural markets operate more efficiently, and overcome some of the other challenges faced by the sector [23]. In Indian context many researches [23] [34] [35] have studied the impact of information and communication technology (ICT) and mobile-enabled agricultural services on extension services delivery and find that mobile telephony has helped creating awareness amongst farmers. However, the impact and performance of government initiatives like Kissan Call Center and SMS services are yet to be empirically and quantitatively explored. There is an evident gap that exists between the information services the government provides and what farmers need. Also, the minimal access of

information by marginal and small farm households is not yet well understood in the literature.

Realizing the need of real time and accurate information for farmer community the Indian government has made continuous efforts to explore innovative mechanism to upgrade the existing agri-supply chain through the vast research base in form of research institutions like ICAR, SAUs, KUS, etc. Mobile phones are rapidly spreading all over India including widespread in rural India and into the hands of poor. The increasing penetration of mobile phones and ICT enabled information services to offer evolutionary possibility for poor rural and agriculture household to overcome the aforementioned barriers to reduce information asymmetry and support extension services. However, insufficient capacity development, infrastructure constraints, and lack of accountability and performance measurement of these ICT initiatives are major hindrances.

Government initiatives and reforms can be evaluated in terms of efficiency, effectiveness and long term sustainability of provided service, quality level and level of farmers' involvement. The performance measurement and improvement initiatives require decomposition of the supply (what is provided) and demand (what was expected) components of extension services. The question is whether the information is not accessible to farmers, or it reaches in a stale state, or it is not relevant enough to add value, is yet to be empirically explored. Moreover, if we look broader viewpoint, another possibility may that the does not allow farmers to exploit the information to its fullest could be the other compelling factors like financial resource and infrastructure constraints. Bridging this research gap could help analysts and policy makers understand the information needs of different types of farmers. Based on the discussion with the academic experts and practitioners, further the identified factor affecting the farmers' satisfaction are grouped in categories as discussed below.

Personal & Farm Attributes: Many research studies have stated farmer's personal attributes as a significant factor affecting his satisfaction with the extension services. [36] and [37] say older farmers are more satisfied because of their experience with the extension services however, farmers with elder age can be less flexible towards adoption of extension's advices hence less satisfied [1] [38]. Farmer's education level also changes the way farmers are able to understand and adopt the extension's advices. Farmer's with higher education can adopt newer technologies in a better manner thus can be more satisfied than the others. Family size and Farm Size might help farmers to mitigate labour shortage, incomplete credit, insurance markets [39] [40]. A higher number of family members involved in agriculture, can lead to better access to labour thus more farmer's satisfaction. On the other hand, if other family members are involved in other occupations their income can empower farmer to adopt newer and costlier technologies, thus more satisfaction. So, farmer's personal attributes like age, education, farm size, family members, and other sources of income can positively or negatively impact the farmer's satisfaction with the extension services.

Economic Gains from the Extension Participation: Perceived economic re-

turns can be a major affecting the farmer's satisfaction. A previous study by Elias, Nohmi, Yasunobu, and Ishida [41], finds out that perceived economic return from extension services by farmers is a significant factor influencing farmer's overall satisfaction with the services.

Extension Package Appropriateness: According to Food and Agriculture Organization [42], the "relevance of agricultural extension activities" is defined as the relationship between existing formulated agricultural extension topics in the extension service with farmers' expressed problems in farm work and need areas for agricultural advice. Also a study [43] noted that farmers are more likely to accept services which are consistent with the local situation and culture. So, we shall consider need-based nature of extension services, market-based, input affordability, availability and quality as the factors which may affect farmer's satisfaction.

Participatory Nature of Extension Program: Many researches have pointed out farmer's participation in planning, implementation as well as evaluation, as an important factor for extension effectiveness. According to the study by Cohen and Lemma [44] the approach to extension service delivery is predominantly top-down, while accountability mainly flowing upward. So, Participatory Nature of Extension Program must be evaluated with Meghalaya in perspective.

Access to Required Information: Many researchers found the lack of required information as a key factor affecting the productivity and income of farmers. A study by Tang, Wang and Zhao [45], indicate that agriculture information including information on inputs & market prices can enhance the farmer's welfare.

Use of Multiple Communication Methods: Extension program's effectiveness mainly depends on its ability to educate and advice the farmer well [46] which can be impacted by the frequency of contact between the farmer and the extension providers, as well as use of multiple communication methods by the department to reach out to various beneficiaries. In addition, extension providers must choose different methods of communication to maximize the effectiveness and efficiency of the services.

To sum up, through literature review many factors are identified which can affect the effectiveness of extension program by impacting farmer's satisfaction. Based on the extensive literature review and interviews with two concerned government officials—Joint Director of Agriculture and Monitoring Cum Evaluation Officer, we present the conceptual framework of constructs that impact the satisfaction level of farmers in Figure 1.

It is necessary to empower all citizens, especially the socially and economically excluded, with their right to monitor all reforms and initiatives as owners and participants of all development and governance processes in their areas of residence. Three important points could be noted about the existing literature. First, the strategic fitment of farmers demand and existing public extension services is less systematically researched in the agricultural sector, especially in Indian context. Second, the existing literature inadequately address the empirical evidence

Figure 1. Construct representation (Adapted from Eilas *et al.*, 2015).

of Information needs for Knowledge Realization of farmers, particularly the small and marginal farmers. And third, there is a need to design alternate innovative marketing channels to supplement existing extension services to enhance famers' competitiveness.

About Meghalaya

Meghalaya is situated in the North East part of India, covering an area of 22489 sq·km. The geographic map of Meghalaya is shown in Figure 2. However, due to a lot of constraints like the undulating topography, communication problem, dispersed population pattern, transport related issues, inadequate credit support, poor marketing system, etc., the net cropped area is only about 9.87% of the total geographical area of the State. The role of the Directorate of Agriculture, Meghalaya is to promote holistic, sustained and equitable intervention for attaining food security; conservation, management, protection and sustainable use of natural resources for improved livelihood; generating gainful rural employment opportunities to alleviate poverty and striving towards an overall balanced economic development of the farming community (reference). Many government organization in Meghalaya are working for the benefits of farmers, Department of Agriculture, Department of Horticulture, Department of Animal Husbandry & Fishery, Krishi Vigyan Kendra, Indian Council of Agricultural Research, etc.

Figure 2. District representation in meghalaya map (Source
http://meghalaya.gov.in/megportal/map).

Objective and Research Questions

The objective of the study is to assess, empirically at the micro level, the impact of the government reforms and initiatives to address current challenges of agricultural extension services in India. The study has three tasks. First, we assess the gap between the required demand of farmers from the public extension services and the services supplied to them. Second, based on the identified supply-demand interface we develop the find the factors that contribute to the farmers' satisfaction from the existing extension services.

The questions the study sought to address include:

Major Research Question:

- What is the overall satisfaction level of farmers with the current agriculture extension program?

The Sub-Questions:

1) *Farmers' Demand Assessment*

➤ What information do farmers value the most? When, how and where they search for information? Do farmers receive raw information or with support services and inputs?

➤ What role extension service agents are playing in transforming the available information in knowledge realization?

➤ What trade off is required between Generalization v/s Localization of farmers' need? Is homogeneity/heterogeneity exists within and among the selected States?

➤ How do farmers deal with situational turbulence, market risk and distortion caused by asymmetric information along the agri-chain?

2) *Extension Service Supply*

➤ What kind of information do farmers receive? Are agriculture extension services are demand driven and meet diverse information expectation of the farmers?

➤ What content is available? Is it relevant? What mechanism is used to convert

the generalized information into localized and customized need? How the feedback mechanism is used to upgrade the existing content?

➢ How can the capacity of extension services can be efficiently build-up to the expected level?

3) *Farmers Satisfaction from the Extension Services*

➢ What are the factors on which the farmers' satisfaction depend?

➢ How to bridge gaps between the existing mismatch between Farmers' Demand and Extension services Supply?

➢ Can farmers act as a community that inherently encourage the development of leadership and management skills so that farmers can demand the information they need?

➢ What other roles extension services can play beyond technology transfer? How to improve the existing marketing mechanism and make them farmer demand driven?

To achieve this objective, this study is divided into two parts:

1) Assessment of Services Being Offered to Farmers: Through available literature and interviews with the concerned officials, we attempt to investigate the present state of services being offered to farmers.

2) Development of Extension Performance Evaluation Model: Based on farmer's response to the services, through a set of structured questionnaire, interviews, and focused group discussions, we attempt to develop performance evaluation model to identify gaps in the performance of extension services and its impact on farmer's satisfaction level. Also, with tried to investigate the reasons for dissatisfaction among the farmers.

3. Conceptual framework and Underpinning Theories

We believe that social initiatives connecting networks across communities may be the greatest hope for overcoming most of the local problems of a global nature. Across the globe, the origin, development, and diffusion of organizing community initiatives are divulged as success stories [47]. The social development approach pursues to integrate economic and social policies within a dynamic development process in order to achieve social welfare objectives. From the ecological theory perspective, we integrate the social and technological aspects of extension services provided to the farmers with a relevant external environment to ensure goal achievement and sustainability [48]. The behavioural aspect of agriculture extension system is expanded through the relationship of people, technology, system and outcome [49].

In economic terms, demand refers to the amount of service or good that a consumer is willing and able to buy at a given price. We describe here demand as a right of farmers to get information and support from public extension services to attain their sustainable livelihood and quality life. Literature suggests that farmers need a breadth of information appropriate technology, optimal use of inputs, changing farm system options, input suppliers, intermediaries, quality

specification, market and trade, time to buy inputs and sell produce, off farm generation options, implication of changing policy access to credit and loans etc. Moreover, Supply, refers to the extension services that are provided in response of farmers' demand, mostly publically driven, facilitate farm households with scientific, technical, marketing and administrative information for a better decision making by farmer along the agri-supply chain.

The broad view of agriculture extension is conceptualized in the framework that includes an interplay of Social system and Environmental system along with the Technical System as shown in Figure 3. The Technical System consists of the tools, techniques, artifacts, methods, configurations, procedures, and knowledge used by Extension Services driving actors/members to acquire inputs, transform inputs into outputs or services for consumers or beneficiaries. The Social System comprises of the people who are part of the system directly or indirectly and all that is human about their presence, such as attitudes, beliefs, relations, cultures, norms, politics, behaviors, and emotions. Community organization theory emphasizes on active participation and developing communities that can better evaluate and solve social problems [50]. The Environmental System is a connector between social and technical systems where a regulated relevant environment is created by Environment system that includes, government initiatives and support, policy and regulation, infrastructure, journalism & media, etc. The policy makers require to align conducive environment to pursue strategies, select resources, and implement technologies.

Government initiatives and reforms can be evaluated in terms of efficiency, effectiveness and long term sustainability of provided service, quality level and level of farmers' involvement. The performance measurement and improvement initiatives require decomposition of the supply (what is provided) and demand (what was expected) components of extension services.
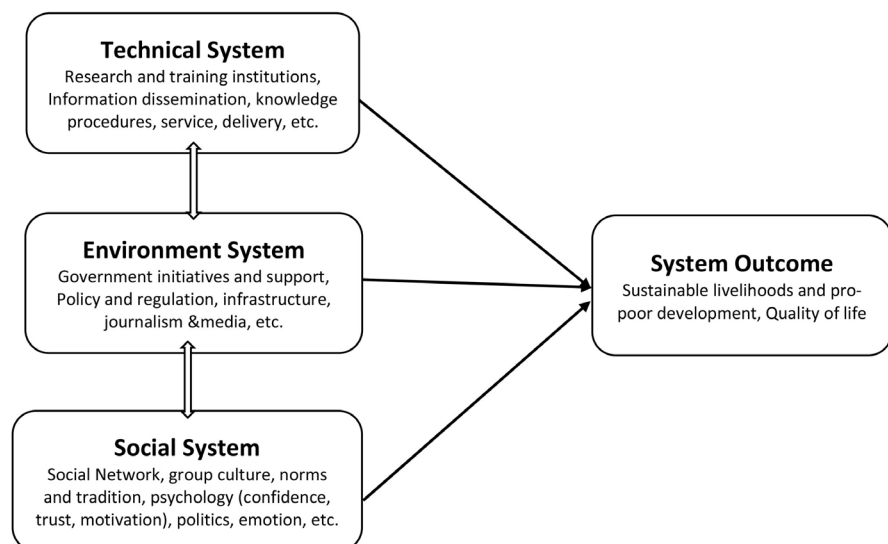

Figure 3. Interplay of Technical, Social and Environmental initiative for livelihood improvement.

There are two facets of engaging and facilitating farmers, viz., Information Dissemination and Knowledge Realization. Information can easily be transferred and is context dependent; whereas, Knowledge realization requires information transformation into situation specific usefulness. Focusing solely on the information provision and dissemination and neglecting Knowledge realization by farmer creates the gap between need of the farmer (Demand) and the services provided (Supply) by extension services.

4. Analytical Framework

As discussed above the agriculture-related research and development inputs result in the contribution to the knowledge body, which effective implementation leads to improvement in agricultural productivity which further outcomes in form of sustainable livelihood of farmers. [41] [51] [52] reported positive impacts of both income progression and cooperative extensions on yield and productivity. The underpinning theory is that expenditures made towards research and development impacts productivity, and that result in overall satisfaction of farmer community. Therefore, the general form of the model is:

$$FS_i = f\left(IP_i, ER_i, FS_i, PE_i, DM_i, CC_i\right)$$

where $i = 1, 2 \cdots, N$ farmers, FS: Farmer's satisfaction, IP: Income Progression, ER: Extension Relevance, FS: Financial Support, PE: Participatory nature of extension, DM: Demographics and CC: Communication Channels.

We use a log formulation for the Farmer Satisfaction function, which is standard in the literature [53] [54]. Considering Farmers Satisfaction as the dependent variable we applied Ordered Logistic Regression in this study. Econometrically, this functional form is describing the input elasticities. For the output elasticity calculations, we use regression coefficients reported in finding section.

The Farmer's Satisfaction was measured on a three point Likert-scale. FS_i that represents the ordered items was defined as:

$$FS_i = \begin{cases} 1: \text{Not Satisfied} \\ 2: \text{Moderately Satisfied} \\ 3: \text{Satisfied} \end{cases}$$

Being the ordinal value, the large value is considered as the satisfaction of the farmers with the extension services. Based on (1) the estimated explicit econometric model is presented in Equation (2):

$$FS_i = \alpha + \beta IP_i + \gamma ER_i + \delta FA_i + \eta PE_i + \lambda DM_i + \rho CC_i + \varepsilon_i$$

where, IP_i, ER_i, FS_i, PE_i are vector of explanatory variables, and α, β, γ and δ are coefficients to be estimated, and ε_i is a random error for i, that is assumed to be independent normal distributed. The ordered logistics function is specified as:

$$F(x) = \frac{e^x}{1 + e^x}$$

The observed Farmer satisfaction variable as determined from the model is as follows:

$$FS_i = \begin{cases} 1 : \text{Not Satisfied if } FS_i \leq 0 \\ 2 : \text{Moderately Satisfied } 0 < FS_i \leq \mu_i \\ 3 : \text{Satisfied if } FS_i > \mu_i \end{cases}$$

where, μ_i is a set of thresholds for the Farmer's satisfaction as estimated with the parameter vector α, β, γ and δ.

The probability related with the responses of an ordered probability model is represented as follows, where j represents the order ranked farmer's satisfaction:

$$P(FS_i = k) = P(\mu_{j-1} < FS_k \leq \mu_j)$$

$$P(FS_i = k) = P(\mu_{j-1} < FS_i = \alpha + \beta IP_i, + \gamma ER_i, + \delta FA_i$$
$$+ \eta PE_i + \lambda DM_i, + \rho CC_i + \varepsilon_i \leq \mu_j)$$

5. Data, Measure and Methods

The study was conducted in four districts of Meghalaya, Viz., (Eat Khasi Hills, West Khasi Hills, Ri-Bhoi, East Garo Hills). The districts were purposively selected as these are located on the geographically covering the states and within the agriculturally active districts in Meghalaya. The target population for this study was all farmers who have registered with government extension services. In each district two villages were selected and in each village 30 farmers were randomly selected using systematic sampling procedure. District Offices. Each District has some blocks, each block has got one Agriculture Development Officer (ADO) and one Horticulture Officer (HDO). ADO & HDO both are assisted by one Demonstrator and one Assistant Inspector. This turns out as one Development Officer has to provide services from 100 to 200 villages. Development Officers are the front line extension workers responsible for on ground implementation of all the schemes. They are responsible for demonstration of new technologies, provide trainings, supervising different programs, helping in proper implementation, as well as coordinating with different departments to help the farmers. Given the restrictions of available funding and manpower, the ADO/HDO can't give services to all the farmers. According to the Monitoring Cum Evaluation Officer, at max the government can provide services to 25% of the total farmers. The sampling frame was the farmer beneficiary list was obtained from the office of ADO/HDO. In case a farmer was not available for the survey, or those identified as key informants, the next consecutive farmer beneficiary on the list was identified. A total of 240 farmers from the eight villages were selected.

As mentioned by Tabachnick and Fidell [55], a sufficient sample size for multivariate data analysis is $n > 50 + 8k$ and for individual predictor is $n > 104 + k$, where k stands for number of independent variables. Further the detailed information was gathered from the focused group discussion with the farmer groups from twenty key informants; five from each village. With the aid of the extension

workers, key informants were selected. This study has six independent variables thus the minimum sample size would be 110. Thus, 240 was deemed sufficiently high for this purpose.

The principal data collection method was conducted first using a structured questionnaire, followed by the focused group discussion and personal interviews of the select farmer groups in each village as the complementary method [56]. The questionnaire, was pre-tested in East Khasi Hill, and face validated by experts in academic and practitioners in agriculture domain. The questionnaire enquired the respondents on the demographic information, in addition to the details on their information needs, the quality and timeliness of the services provided by the extension workers, farmers' perception. The data collection and focused group discussions were carried out between November 2017 and July 2018.

The quantitative data collected was grasped in descriptive statistics to find frequencies and mean values. The reliability of sample data is checked using Cronbach's Alpha test. Further, the sources of information accordingly analysed for data reduction employing factor analysis. Additionally, using multi-variate regression, a model was developed representing the causal impact of identified factors on the farmers' satisfaction level based on Regression Analysis. Information gathered through focused group discussion was analysed thematically [57] and has been used to explicate the discussion of the findings of the survey instrument.

6. About the Questionnaire

Farmers' satisfaction in this study is deliberated as the response of a farmer towards the supply and use of public extension service and fulfilment of certain prior expectations related to a product or service [58]. There are many personal and farm factors on which the farmers' satisfaction depends like, age, education, family size, land size and livestock ownership, economic return, participatory nature of extension workers, communication channels, training, etc. Based on the aforementioned literature, discussion with academicians and practitioners working in the field of agriculture extension the variables impacting the farmers satisfaction level were identified. After two round of discussion sessions, 24 variables had been identified, but this number was reduced to 15 as some variables were overlapping and some were of same nature. These factors are shown in Table 1.

7. Findings and Discussion

A descriptive analysis of the sample showed farmers were from Eat Khasi Hills (34%), West Khasi Hills (24%), Ri-Bhoi (27%) and East Garo Hills (15%). 72% of respondents were males. A small percentage (8%) were 18 - 30 years old; 40% were in the range of 31 - 50 years old and over half of the sample (52%) fell in the older than 50 years age. Most farmers (64%) had primary level education, 23% completed secondary education, 9% possessed higher secondary, and the

Table 1. Variable and measurement summary.

S.No	Variable	Measurement
	Demographics	
1	Location	1 = EKH, 2 = WKH, 3 = RB, 4 = EGH
2	Age	Household head age in years
3	Education	0 = Illiterate, 1 = Literate
4	Family Size	Numbers
5	Livestock	Numbers
6	Years registered with extension	Numbers
7	Number of Family Members involved in agriculture	Numbers
8	Number of Family Members involved in other occupations	Numbers
9	Overall satisfaction from extension services	1 = Not Satisfied, 2 = Moderate, 3 = Satisfied
10	Income from other sources	in Rs. Per year
11	Frequency of extension contact	0 = Not even once in a year, 1 = Once a year, 2 = Monthly, 3 = Weekly
12	Agriculture productivity after enrolling with extension	1 = Deteriorated, 2 = Moderate, 3 = Improved
13	Agriculture income after enrolling with extension	1 = Deteriorated, 2 = Moderate, 3 = Improved
14	Food self-sufficiency status after enrolling	1 = Deteriorated, 2 = Moderate, 3 = Improved
15	Cash crop production after enrolment	1 = Deteriorated, 2 = Moderate, 3 = Improved
16	Extension services are as per need	1 = Disagree, 2 = Moderate, 3 = Agree
17	Extension services are as per market requirement	1 = Disagree, 2 = Moderate, 3 = Agree
18	Extension Services are affordable	1 = Disagree, 2 = Moderate, 3 = Agree
19	Quality of extension services are good	1 = Disagree, 2 = Moderate, 3 = Agree
20	Extension services are timely in nature	1 = Disagree, 2 = Moderate, 3 = Agree
21	Support related to insurance	1 = Disagree, 2 = Moderate, 3 = Agree
22	Support related to credit schemes	1 = Disagree, 2 = Moderate, 3 = Agree
23	Extension services is community based	1 = Disagree, 2 = Moderate, 3 = Agree
24	Involvement in service design and implementation	1 = Disagree, 2 = Moderate, 3 = Agree
25	Service design is beyond agriculture	1 = Disagree, 2 = Moderate, 3 = Agree
26	Involvement in evaluation	1 = Disagree, 2 = Moderate, 3 = Agree
27	Multiple communication channel used by extension (Home Visit, Farm Visit, On farm demonstration, Demonstration at training centre, Office/Department Visit, Exhibition, Print Media, Television, Radio, Telephone (SMS/Call))	1 = Never; 2 = Sometimes; 3 = Frequently

minority (2%) were graduated. 78% of the farmer respondents were full time engaged in farming activities, however 22% engaged in other activities along with farm activities on a part time basis.

With reference to extension visits to farm and households, 35% of respondents stated that no one from extension office visited them, 8% of farmers re-

ported that fortnightly basis extension worker visit them, 20% reported once in a monthly visit, 25% experienced annual visits and the rest did not make any comments on this as they were not very sure to responds. A majority of the respondents (97%) favoured face-to-face interaction and need based assistance from the extension workers. Most of the farmers (81%) mentioned that they are not dependent on extension workers and they access other sources of information. Finally, most farmers (86%) indicated they get information from fellow farmers and input dealers.

As depicted in Table 2, KMO score of 0.822 indicates that the sample is adequate for factor analysis. Also, Barlett's Test indicates a positive result with P value less than 0.05. Farmer's satisfaction is not significantly correlated with many of the demographic attributes like years of experience in extension participation, age, education, and family members involved in other occupations. It is found positively related with farm size, number of family members involved in agriculture, agri-input availability and agri-input quality.

Numbers of times training received was found correlated with education level of farmers & frequency of contact between the farmer and the extension workers. Trainings received was also found correlated with perceived enhancement of productivity, perceived income growth by farmers, need-based nature of services, participatory nature of services, frequency of credit, use of different communication methods along with access to required information on agri-inputs, latest techniques and credit schemes. Numbers of times training received was not found correlated with access to market price information and insurance scheme information.

Agri. Input's Availability like those of seed, manure, equipment and their Quality along with information about their use may lead to perception of improvement in crop productivity and that the services are based on the user's needs. We combine these interrelated factors under the head—"Yield Growth", as these factors contribute to improvement in the yield of farmers. Market Based Nature of Services can fetch a higher price for the farmers produce, which is why it is related with Perceived Income Growth for the farmer. These two factors lead to fulfilment of needs of the whole family. Fetching a higher price also requires farmer's the updated Market Price Information. These factors combined lead to Income Growth for the farmers. Farmer's Participation in planning & implementation of the extension services along with his inputs is service evaluation certainly leads to higher satisfaction of the farmers. Insurance schemes and Credit availability & related schemes add to Financial Security of the farmers (Table 3, Table 4).

In Table 5, the test for model appropriateness and goodness of fit with the proportional odds assumption test (x^2 = 13.46, P = 0.437) confirms that regressed parameters are the equivalent across logits confirming the relevance of the ordered logistic model to explore the effect of determinants on the dependent variable. In other words we can mention here that we do not have enough

KMO and Barlett's Test		
Kaiser-Meyer-Olk in Measure of Sampling Adequacy.		0.822
Barlett's Test of Sphericity	Appox. Chi-Square	1062.929
	df	91
	Sig.	0.000

Table 3. Factor analysis—total variance explained—principal component analysis.

Rotated Component Matrix				
	Component			
	1	2	3	4
Agriculture productivity after enrolling with extension	0.821	0.069	0.250	0.151
Agriculture income after enrolling with extension	0.797	0.188	0.335	0.081
Food self-sufficiency status after enrolling	0.786	0.130	0.270	0.009
Cash crop production after enrolment	0.657	0.122	0.417	−0.073
Extension services are as per need	0.260	0.835	0.033	0.080
Extension services are as per market requirement	0.351	0.805	0.342	0.154
Extension services are affordable	0.343	0.792	0.355	0.083
Quality of extension services are good	0.056	0.627	0.179	0.332
Extension services are timely in nature	0.171	0.591	0.412	0.170
Support related to insurance	0.112	0.085	0.843	0.381
Support related to credit schemes	0.253	0.069	0.748	0.528
Extension services is community based	0.219	0.196	0.151	0.908
Involvement in service design and implementation	0.215	0.197	0.213	0.904
Service design is beyond agriculture	−0.063	0.053	0.083	0.863
Involvement in evaluation	0.077	0.072	0.169	0.821

evidence to reject the null hypothesis and the insignificant chi-square value recommends that order logit's assumptions are met and the regression results are significant.

As indicated in Table 6, family size, credit, off-farm income, perceived economic return and frequency of extension contact were significant determinants of farmers' satisfaction with agricultural extension, service whereas other proposed predictors such as age, education, livestock ownership, extension experience, training, participatory nature of the program, perceived package appropriateness and use of multiple communication methods were not significant.

We investigated into the probable reasons to figure out the reasons behind the same. The model developed using the above frameworks is used and the four identified package appropriateness measurement components are evaluated in

Table 4. Factor analysis-construct development.

	Constructs
Agriculture productivity after enrolling with extension	
Agriculture income after enrolling with extension	
Food Self-sufficiency status after enrolling	Income Progression
Cash crop production after enrolment	
Extension services are as per need	
Extension services are as per market requirement	
Extension services are affordable	Extension Relevance
Quality of extension services are good	
Extension services are timely in nature	
Support related to Insurance	
Support related to credit schemes	Financial Support
Extension services is community based	
Involvement in service design and implementation	Participatory Nature of
Service design is beyond agriculture	Extension
Involvement in evaluation	

Table 5. Test for model appropriateness and goodness of fit.

Model appropriateness and goodness-of-fit		
Test	**Chi-Square**	**P-Value**
Proportional odds test	13.46	0.437
Likelihood ratio	93.33	0.013

the order of their significance to identify gaps and figure out some policy implications, which are as follows:

a) *Income Growth for the Farmers*: Income Growth for the farmers was the most important identified component for the extension package. 60% surveyed beneficiaries are not satisfied with the market based nature of services, many reporting that they are unable to sell at good prices because of less demand for the produce (produced with the help of extension department), or lack of storage infrastructure, poor access to market, presence of brokers and their influence, etc. Along with that, 93% of the surveyed farmer's lack satisfactory access to market price information which is significantly related with the income growth and satisfaction with the extension program.

Policy Implication: Farmers should be provided with good crops to produce (based on market demand forecast along with their soil type & weather conditions to increase their yield and maximize potential profit). Market Access to farmers can be enhanced by providing them with timely and relevant market price information, maybe through SMS or Interactive Voice Response (IVR)

Table 6. Order logit estimation.

Variables	Parameter Estimation	SE	P-Value	Odds Ratio
Location	0.0322	0.0654	0.763	1.007
Age	−0.0113	0.0341	0.326	0.784
Education	0.0456	0.0211	0.721	1.034
Family size	0.3164	0.3312	0.081*	1.621
Years registered with extension	−0.0322	0.0654	0.431	0.873
Number of Family Members involved in agriculture	0.2123	0.3122	0.041**	1.541
Number of Family Members involved in other occup	0.0405	0.0311	0.043**	1.023
Frequency of extension contact	1.1562	0.6234	0.031**	3.143
Income progression	2.7345	0.4353	0.000***	9.567
Extension relevance	0.1873	0.6573	0.643	1.126
Financial security	−0.4324	0.3129	0.091*	0.314
Participatory nature of extension	0.2602	0.5392	0.134	1.464
Active contact	0.5438	0.9823	0.445	1.642
Passive contact	0.4435	0.8721	0.647	1.323
Threshold value	2.76	0.433	0.000***	
Log Likelihood	−76.8973			
Pseudo R-square	0.43			

Service over phone. IVR services have proven success record in reaching out to farmers and benefitting them especially in information facilitation area.

b) *Financial Security*: Despite presence of schemes like Pradhan Mantri Fasal-Bima Yojana (PMFBY) and Kisan Credit Card, 96% and 92% of the surveyed farmers lack satisfactory level of access to information about Insurance Schemes and Credit Schemes respectively. This lack of access to required information severely affects them in two ways—One, their satisfaction level goes down which negatively impacts their productivity; two, they approach unorganized sector for credit in case of emergencies. The creditor often seizes their crops in lieu of the credit granted, which often forces them to accept lower prices for their produce.

Policy Implication: Farmers must be provided with knowledge on the financial products including insurance as well as credit schemes. Documentation and other procedural complexities should be eased and should be well communicated with the farmers, maybe through village headmen or extension providers.

c) *Yield Improvement*: 71% of the surveyed farmers are not satisfied with the need-based nature of extension services. 87% of them are not satisfied with the information access to latest techniques, 75% are not satisfied with the information access to agricultural inputs like seeds, manure & equipment. However, 42% of the farmers are satisfied with the improvement in crop productivity mainly attributable to good quality seeds provided by the extension department. The

state is transforming from chemical based farming to organic manure based, since 2015. This is combined with lack of knowledge, willingness to shift to organic farming and lack of adoption for integrated farming, farmers are acquiring costlier chemical fertilizers and pesticides from the market. Many farmers said their soil's fertility is severely down so they are putting more and more fertilizers. This is increasing their cost of production and reducing yields. Main issues here are lack of training and help in implementation of the extension services.

Policy Implication: Trainings should be provided more frequently to the extension beneficiaries (40% of the surveyed didn't receive any in the last three years). Many farmers said trainings provided are irrelevant because they can't implement what is being taught in the training. Training should be provided with the increased focus on implementability of the same. Extension providers should increasingly focus on adoption of integrated farming systems and organic manures through the trainings provided. Also, one more point to note here is that active contacts (On Farm Demonstration, Demo at Training Centre, Home, Farm Visit by Extension Workers, Extension Department Visit by the farmers, and Telephone—SMS and Calls) work better to improve the yield of farmers.

d) *Participatory Nature of extension services*: 80% of the surveyed beneficiaries are not satisfied with their participation in planning, implementation and evaluation of the services. Participatory nature of extension services is also related with the need based nature of services, thus it impacts the adequacy of the extension program.

Policy Implication: More active participation of the farmers' should be sought by the extension department. This can be done by providing training in the form of facilitation of knowledge rather than imposition of knowledge, and taking their feedbacks at regular intervals.

The assessment of farmer's demand is an important factor to consider for better addressing the extension services efforts. Demand side includes the expectation of farmer in terms of affirmed and committed services and accountability by better governance. This includes, policies that make farmers more competitive, relevant and timely information right, improved credibility of existing extension structure, political decentralization for better inclusion and participation of famers and community voices. The extension services supply-side includes the administration and delivery of public support initiatives, public expenditure management reforms, training programs for public officials, changes in procurement and audit procedures, and efforts to coordinate the activities of government agencies and departments. Another activity is to coordinate and facilitate role and to create an enabling environment for the private and third sectors [17]. Reform policies to strengthen extension services will have tiny impact if there is a misfit between farmer demand expectation and service supplies.

The business terms Push and Pull originated and widely used in logistics and supply chain management literature. A push-pull system in business defines the flow of a product or information between two links of a network. The consumers usually "pull" the goods or information they demand for their needs, while the

suppliers "push" them toward the consumers based on the expected demand. The interface between these stages is called the Push-Pull Boundary as a strategic fit between the push and pull reform approaches.

There is always a trade-off between the generalization and localization of efforts with respective cost implications. The demand side requirements are: What information do different types of farmers need, and when is that information needed? However, providing farmers with locally relevant and specific information can be an extremely expensive and time consuming process. Moreover, not all information has to be generated through community demands. For instance, information about climate change, hygiene, and nutrition etc. could initially be provided to farmers for making them awareness to further provoke their requirements. As the local community need and service provided differ in terms of characteristics, a customized mechanism is required for improving service provision for sustainable long term rural development. The Push-Pull boundary brings in the strategic fit between generalized policy formulation and localized situational content. Furthermore, it will also emphasize on decentralized initiatives rather than engaging in ambitious reform programs that address all service delivery problems at the same time. Push-Pull boundary suggests that reform approaches should centre on policies of best fit rather than best practice that leads to customized policy reforms and governance performance measures.

8. Conclusions

Meghalaya, principally an agrarian State with rich agro-biodiversity has yet to unleash its agricultural potential. Many of the commercial and unique produce of Meghalaya still find difficulty in reaching appropriate market. Due to inadequate support from agriculture extension services on required input and market information, the majority of the farmers are confined to sell their produce in local village markets with negligible profit margins. A majority of the farmers are not well aware of different agriculture extension programs that may help them to get better market and price for their produce. Only a handful of the farmers in the State have access to such extension services and relevant marketing platforms.

With an objective to empirically understand the determinants impacting the satisfaction level of farmers we conducted an in-depth study to access the present situation of agricultural extension services in Meghalaya. This helped us to identify the potential gaps and the need for change. After presenting the critical literature review we presented the constructs framework to establish the linkage between Farmers Satisfaction and its determinants within the larger framework of sustainable livelihood and pro-poor development. A thorough analysis of various issues linked with extension services from farmer side production to customer side consumption, including subsidy, cost, price fluctuation, transportation, storage, agriculture trade, etc. is discussed that have a major policy level implications.

Meghalaya's public extension program for farmers is heavily subsidized presently focusing on enhancing farmers' income along with reducing their income fluctuations through the adoption of Integrated Farming Systems, in which farmers take the benefit of all the line departments namely agriculture, horticulture, fishery, animal husbandry & veterinary, soil conservation and forestry. Due to limitations of finance and manpower, mainly front line extension workers, and most farmers do not become the beneficiary of the program at all. The major components of performance evaluation of the extension program identified on the basis of several factors indicating farmers' expectation from the extension providers are improvement in income, financial security, productivity (yield) and their participation in service planning, implementation and evaluation.

With the evaluation model formed consisting of above mentioned four components consisting of several factors, the most important gaps are, in order of their importance—services which are not market based, lack of farmer's access to market prices, lack of access to financial products like insurance and credit schemes, poor need-based nature of present program, lack of information on latest techniques and poor participatory nature of the program.

Policy implications are provided to give focused and customized services to the beneficiaries which included providing crops based on forecasted demand and farmer's soil & weather type, easing access to financial products by reducing procedural complexities and enhancing information flow, providing more frequent and implementable trainings along with focus on providing trainings in the form of facilitation of knowledge rather than imposition of knowledge, and colleting farmer's feedback at regular intervals for continuous monitoring of the extension program and making it more need-based.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Hegde, N.G. (2005) Traditional Extension Methods in Modern Agriculture. Indian Farming Special Issue on World Food Day, 45-47.

[2] Bhusan, S. and Tirupati, D. (2013) System Dynamics Investigation of Capacity Building by Humanitarian Supply Chain in Disaster Prone Eco-Communities of India. Working Paper No. 416, Supply Chain Center, IIM, Bangalore. https://doi.org/10.2139/ssrn.2303641

[3] Davis, K., Babu, S.C. and Sylvia, B. (2014) The Role of Extension and Advisory Services in Building Resilience of Smallholder Farmers. *Building Resilience for Food and Nutrition Security*, Addis Ababa, 15-17 May 2014, 2020 Resilience Conference Brief 13, 1-4.

http://www.ifpri.org/sites/default/files/publications/2020resilienceconfbr13.pdf

[4] Glendenning, C.J., Babu, S. and Asenso-Okyere, S. (2010) Review of Agricultural Extension in India: Are Farmers' Information Needs Being Met? IFPRI Discussion Paper 01048.

[5] Birner, R., Davis, K., Pender, J., Nkonya, E., Anandajayasekeram, P., Ekboir, J., Mbabu, A., Spielman, D., Horna, D. and Benin, S. (2006) From Best Practice to Best Fit: A Framework for Analyzing Agricultural Advisory Services Worldwide. Development Strategy and Governance Division, Discussion Paper No. 39, International Food Policy Research Institute, Washington DC.

[6] Davis, K., Swanson, B., Amudavi, D., Ayalew, D., Flohrs, A., Riese, J., Lamb, C. and Zerfu, E. (2010) In-Depth Assessment of the Public Agricultural Extension System of Ethiopia and Recommendations for Improvement. IFPRI Discussion Paper No. 01041, Washington DC.

[7] Kokate, K.D. (2009) Developing Farmer-Led and Market-Led Extension System: Paradigm Shift and Experiences. *National Seminar on Agriculture Extension*, Maharashtra, May 2009, 18-21.

[8] Swanson, B.E. (2006) The Changing Role of Agricultural Extension in a Global Economy. *Journal of International Agricultural and Extension Education*, **11**, 5-17. https://doi.org/10.5191/jiaee.2006.13301

[9] Sulaiman, R.V. and Hall, A. (2008) The Fallacy of Universal Solutions in Extension: Is ATMA the New T&V? https://pdfs.semanticscholar.org/7198/47c7dd57b94355aca141a640fb41a68baea7.pdf

[10] Birner, R. and Anderson, J.R. (2007) How to Make Agricultural Extension Demand-Driven? The Case of India's Agricultural Extension. Discussion Paper 729.

[11] Anderson, J.R., Feder, G. and Ganguly, S. (2006) The Rise and Fall of Training and Visit Extension: An Asian Mini-Drama with an African Epilogue. Policy Research Working Paper 3928, World Bank, Washington DC.

[12] Davis, K. (2006) Farmer Field Schools: A Boon or a Bust for Extension in Africa? *Journal of International Agricultural and Extension Education*, **13**, 91-97. https://doi.org/10.5191/jiaee.2006.13109

[13] National Sample Survey Organisation (NSSO) (2005) Situation Assessment Survey of Farmers: Access to Modern Technology for Farming. National Sample Survey, 59th Round (January-December 2003) Report 499 (59/33/2), Government of India, Ministry of Statistics and Programme Implementation, New Delhi.

[14] Sulaiman, R. and Davis, K. (2012) The "New Extensionist": Roles, Strategies, and Capacities to Strengthen Extension and Advisory Services. Global Forum for Rural Advisory Services, Lindau.

[15] Babu, S.C., Glendenning, C.J., Asenso-Okyere, K. and Govindarajan, S.K. (2011) Farmers' Information Needs and Search Behaviors: Case Study in Tamil Nadu, India. International Food Policy Research Institute, Washington DC.

[16] Cole, S. and Hunt, S. (2010) Information, Expectations, and Agricultural Investment: Evidence from a Field Experiment in India. Policy Research Working Paper 6546, World Bank, Washington DC.

[17] Raabe, K. (2008) Reforming the Agricultural Extension System in India What Do We Know about What Works Where and Why? IFPRI Discussion Paper 00775.

[18] Sulaiman, R. and Holt, G. (2002) Extension, Poverty and Vulnerability in India: Country Study for the Neuchâtel Initiative. Working Paper 154, Results of ODI Research Presented in Preliminary form for Discussion and Critical Comment, Over-

seas Development Institute, London.

[19] Sulaiman, R.V. and Hall, A.J. (2003) India: The Emergence of Extension-Plus: Future for Extension beyond Technology Transfer? In: Rivera, W.M. and Alex, G., Eds., *Volume* 1. *Decentralized Systems*, *Case Studies of International Initiatives Agriculture and Rural Development*, Discussion Paper 8, Extension and Rural Development, Washington DC, 19-29.

[20] Sulaiman, R. and Van den Ban, A.W. (2003) Funding and Delivering Agricultural Extension in India. *Journal of International Agricultural and Extension Education*, **10**, 21-30. https://doi.org/10.5191/jiaee.2003.10103

[21] Diekmann, F., Loibl, C. and Batte, M.T. (2009) The Economics of Agricultural Information: Factors Affecting Commercial Farmers' Information Strategies in Ohio. *Review of Agricultural Economics*, **31**, 853-872. https://doi.org/10.1111/j.1467-9353.2009.01470.x

[22] Azumah, S.B., Donkoh, S.A. and Awuni, J.A. (2018) The Perceived Effectiveness of Agricultural Technology Transfer Methods: Evidence from Rice Farmers in Northern Ghana. *Cogent Food & Agriculture*, **4**, Article ID: 1503798. https://doi.org/10.1080/23311932.2018.1503798

[23] Mittal, S., Gandhi, S. and Tripathi, G. (2010) Socio-Economic Impact of Mobile Phones on Indian Agriculture. ICRIER Working Paper No. 246, Indian Council for Research on International Economic Relations (ICRIER), New Delhi.

[24] Veeraraghavan, R., Naga Y. and Toyama, K. (2009) Warana Unwired: Replacing PCs with Mobile Phones in a Rural Sugarcane Co-Operative. *Information Technologies and International Development*, **5**, 81-95. http://itidjournal.org/itid/article/view/327/150

[25] Aker, J. (2011) Dial "A" for Agriculture: A Review of Information and Communication Technologies for Agricultural Extension in Developing Countries. Working Paper 269, Center for Global Development, Washington DC. https://doi.org/10.2139/ssrn.1942954

[26] Bhatnagar, S. (2008) Benefits from Rural ICT Applications in India: Reducing Transaction Costs and Enhancing Transparency? LIRNEasia Presentation at Public Lecture on ICT in Agriculture, Colombo. http://www.lirneasia.net/wp-content/uploads/2008/02/bhatnagar_public_lecture.pdf

[27] De Silva, H. and Ratnadiwakara, D. (2008) Using ICT to Reduce Transaction Costs in Agriculture through Better Communication: A Case Study from Sri Lanka. LIRNEasia, Sri Lanka. http://www.lirneasia.net/wp-content/uploads/2008/11/transactioncosts.pdf

[28] Kumar, P. and Mittal, S. (2006) Agricultural Productivity Trends in India: Sustainability Issues. *Agricultural Economic Research Review*, **19**, 71-88.

[29] Kumar, P. and Rosegrant, M.W. (1994) Productivity and Sources of Growth for Rice in India. *Economic and Political Weekly*, **29**, A183-A188.

[30] Hanson, J.C. and Just, R.E. (2001) The Potential for Transition to Paid Extension: Some Guiding Economic Principles. *American Journal of Agricultural Economics*, **83**, 777-784. https://doi.org/10.1111/0002-9092.00207

[31] Fan, S., Hazell, P.B. and Thorat, S. (1999) Linkages between Government Spending, Growth, and Poverty in Rural India. Vol. 110, International Food Policy Research Institute, Washington DC.

[32] Samaddar, A. (2006) Traditional and Post-Traditional: A Study of Agricultural Rituals in Relation to Technological Complexity among Rice Producers in Two Zones of West Bengal, India. *Culture & Agriculture*, **28**, 108-121.

https://doi.org/10.1525/cag.2006.28.2.108

[33] Lele, U., Pretty, J., Terry, E., Trigo, E. and Klousia, M. (2010) Transforming Agricultural Research for Development. *Global Conference on Agricultural Research for Development*, Montpellier, 28-31 March 2010, 1-25.

[34] Glendenning, C.J. and Ficarelli, P.P. (2012) Content Development and Management Processes of ICT Initiatives in Indian Agriculture. IFPRI Discussion Paper 01180. http://www.ifpri.org/sites/default/files/publications/ifpridp01180.pdf

[35] Krishnareddy, P. and Ankaiah, R. (2005) A Framework of Information Technology-Based Agriculture Information Dissemination System to Improve Crop Productivity. *Current Science*, **88**, 1905-1913.

[36] Lavis, K.R. and Blackburn, D.J. (1990) Extension Clientele Satisfaction. *The Journal of Extension*, **28**, 28-36.

[37] Terry, B.D. and Israel, G.D. (2004) Agent Performance and Customer Satisfaction. *The Journal of Extension*, **42**. http://www.joe.org/joe/2004december/a4.php

[38] UNDP (2013) Human Development Report. UNDP, New York.

[39] Zerfu, D. and Larsony, D.F. (2011) Incomplete Markets and Fertilizer Use: Evidence from Ethiopia.

[40] Ayalew, D. and Deininger, K. (2012) Causes and Implications of Credit Rationing in Rural Ethiopia. The Importance of Spatial Variation. Policy Research Working Paper No. 6096, The World Bank e-Library.

[41] Elias, A., Nohmi, M., Yasunobu, K. and Ishida, A. (2015) Farmers' Satisfaction with Agricultural Extension Service and Its Influencing Factors: A Case Study in North West Ethiopia. *The Journal of Agricultural Science*, **17**, 39-53.

[42] FAO (1995) Improving the Relevance and Effectiveness of Agricultural Extension Activities for Women Farmers: An André Mayer Research Study. FAO, Rome.

[43] Brennan, M.A. (2005) The Importance of Incorporating Local Culture into Community Development. EDIS, Florida Cooperative Extension Service, University of Florida, Gainesville.

[44] Cohen, M.J. and Lemma, M. (2011) Agricultural Extension Services and Gender Equality: An Institutional Analysis of Four Districts in Ethiopia. IFPRI Discussion Paper No. 01094, Washington DC.

[45] Tang, C., Wang, Y. and Zhao, M. (2015) The Implications of Utilizing Market Information and Adopting Agricultural Advice for Farmers in Developing Economies. *Production & Operations Management*, **24**, 1197-1215. https://doi.org/10.1111/poms.12336

[46] Ragasa, C., Mazunda, J. and Kadzamira, M. (2016) The Impact of Agricultural Extension Services in the Context of a Heavily Subsidized Input System: The Case of Malawi. http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/130088 https://doi.org/10.2139/ssrn.2740420

[47] Patterson, K.L. and Silverman, R.M. (2013) Institutions and the New Normal for Community Development. In: *Schools and Urban Revitalization*, Routledge, Abingdon-on-Thames, 21-31. https://doi.org/10.4324/9780203079669

[48] Joshi, R., Wani, S.H., Singh, B., Bohra, A., Dar, Z.A., Lone, A.A., Singla-Pareek, S.L., *et al.* (2016) Transcription Factors and Plants Response to Drought Stress: Current Understanding and Future Directions. *Frontiers in Plant Science*, **7**, 1029. https://doi.org/10.3389/fpls.2016.01029

[49] Bronfenbrenner, U. (1994) Ecological Model of Human Development. In: Husten, T. and Postlethwaite, T.N., Eds., *International Encyclopedia of Education*, Vol. 2,

Pergammon Press, Oxford, 3-27.

[50] Berkes, F. and Folke, C. (1998) Linking Sociological and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience.

[51] Ganpat, W., Badrie, N., Walter, S., Roberts, L., Nandlal, J. and Smith, N. (2014) Compliance with Good Agricultural Practices (GAPs) by State-Registered and Non-Registered Vegetable Farmers in Trinidad, West Indies. *Food Security*, **6**, 61-69. https://doi.org/10.1007/s12571-013-0322-4

[52] Evenson, R.E. (2001) Economic Impacts of Agricultural Research and Extension. In: Gardner, B.L. and Rausser, G., Eds., *Handbook of Agricultural Economics*, Vol. 1, Elsevier, Baltimore, 573-628. https://doi.org/10.1016/S1574-0072(01)10014-9

[53] Czarnitzki, D., Glänzel, W. and Hussinger, K. (2009) Heterogeneity of Patenting Activity and Its Implications for Scientific Research. *Research Policy*, **38**, 26-34. https://doi.org/10.1016/j.respol.2008.10.001

[54] Ó hUallacháin, B. and Leslie, T.F. (2007) Producer Services in the Urban Core and Suburbs of Phoenix, Arizona. *Urban Studies*, **44**, 1581-1601. https://doi.org/10.1080/00420980701373453

[55] Tabachnick, B.G. and Fidell, L.S. (2007) Using Multivariate Statistics. 4th Edition, Pearson Education, New York.

[56] Morgan, D.L. (1998) Practical Strategies for Combining Qualitative and Quantitative Methods: Applications to Health Research. *Qualitative Health Research*, **8**, 362-376. https://doi.org/10.1177/104973239800800307

[57] Leech, N.L. and Onwuegbuzie, A.J. (2007) An Array of Qualitative Data Analysis Tools: A Call for Data Analysis Triangulation. *School Psychology Quarterly*, **22**, 557-584. https://doi.org/10.1037/1045-3830.22.4.557

[58] Raboca, H. (2006) Determinants of Customer Satisfaction and Service Quality: The Case of Romanian Public Services. *Transylvanian Review of Administrative Sciences*, **16**, 124-135.