



Determinants of Efficient Needs Delivery to Farmers of Odisha, India: A Multi-approach Constraint Analysis

Satyabrata Mohanty ^{a+++*} and SD Mukhopadhyay ^{a#}

^a Department of Agricultural Extension, PSB, Visva-Bharati, Sriniketan, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Extension and Advisory Service (EAS) providers serve as the primary means of delivering these needs and play a crucial role in improving agricultural output; yet, farmers have challenges related to the effective implementation of these services. This study seeks to identify the primary challenges encountered by farmers in Odisha. Utilizing an exploratory study design with two methodologies, namely Mean Percent Score and Garrett's Ranking procedure, the issues were prioritized. Farmers had challenges with the EAS in three primary domains: social skills, empowerment, and innovation adoption. Poor leadership development training under the Social Skill with a mean garret score with 77.14 ranked 1, the casual approach from EAS towards empowerment issues under empowerment with a mean garret score of 77.07 ranked 2 and finally high investment required for adopting recommended practices ranked third in the Adoption of

⁺⁺ Ph.D. Scholar;

[#] Professor;

^{*}Corresponding author: E-mail: msatyabrata1@gmail.com;

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Innovation with a mean garret score of 76.81. The study proposes targeted solutions to the challenges encountered by farmers in the region via a collaborative approach involving all stakeholders.

Keywords: *Problem prioritization; Extension and Advisory Service (EAS); garrett's ranking; mean percent score.*

1. INTRODUCTION

When it comes to increasing agricultural output and ensuring its long-term viability, one of the most important factors is the prompt and efficient delivery of necessities to farmers. (Shukla et al., 2022, 2024) Effective delivery systems guarantee that farmers obtain information, resources, and technology that are important for improving their farming methods in a timely manner and that are relevant to their needs. It is essential to go through this process in order to bridge the gap between agricultural research and practical application, which will ultimately contribute to the improvement of economic growth and food security. In India, there is a considerable disparity in access to agricultural information as well as technology, which has an impact on the techniques that are used to produce crops. By addressing these gaps and improving agricultural results, it is necessary to have information delivery systems that are both effective and efficient (Krishna and Naik, 2020, Faure et al. 2016). The suppliers of Extension and Advisory Services (EAS) are, in essence, the means by which these requirements are presented. In spite of the fact that EAS plays a significant part in increasing agricultural output, the efficacy of this system is dependent on a number of elements, including the delivery mechanisms that are in place and the availability of information to farmers (Kumar et al., 2017; Das & Sahoo, 2012). They are confronted with a multitude of challenges that hinder their effectiveness in providing agricultural extension and advisory services. These challenges include a lack of coordination, which can result in conflicting information being provided (La et al., 2020), disrupted institutional relationships, and unclear pathways for obtaining necessary

information (Mubangizi et al., 2005). Additionally, inconsistencies in government programs and inadequate support for extension staff further exacerbate the challenges that extension service providers face (Ajani and Onwubuya (2013). The current study was carried out with the intention of analyzing the issues that are impacting the farmers in Odisha in terms of effective requirements delivery due to the EAS providers. This evaluation was carried out in light of the background information provided above.

2. METHODOLOGY

The current research employed an exploratory research design characteristic of social science inquiry. The primary objective was to examine the challenges encountered by farmers in the state characterized by a high growth rate of Gross State Domestic Product from Agriculture (GSDPA) and a low instability as indicated by the Cuddy Della Vale Index (CDVI), signifying an economically stable environment. Among the various states of India, Odisha was chosen for the study through purposive random sampling.

In the districts of Odisha, a purposive random sampling method was employed, focusing on Cropping Intensity, leading to the selection of Rayagada and Puri districts. Additionally, a random selection was made involving 6 blocks, 24 villages, and 192 respondents for the purpose of the study. The data was gathered through a meticulously organized schedule utilizing the EAS-Y scoring tool (Grovermann, 2022), encompassing nine comprehensive domains: factors influencing technical knowledge and skills, entrepreneurial abilities, social competencies, innovation adoption, enhanced access to services, empowerment, economic

Chart 1. Sampling procedure

Odisha (State)	Purposive Random Sampling Criteria: High CAGR and Low CDVI
Puri and Rayagada (Districts)	Purposive Random Sampling Criteria: Cropping Intensity
6 Blocks and 24 Villages	Simple Random Sampling
192 Respondents	Simple Random Sampling

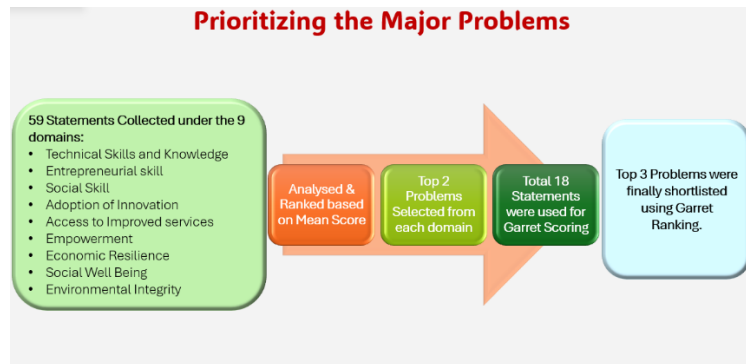


Fig. 1. Sampling procedure

resilience, social well-being, and environmental integrity.

The analysis was conducted in two phases; in the first phase, statements were evaluated and ranked utilizing the Mean Percent Score (MPS) methodology. The formula employed for the calculation of the MPS is as follows:

$$\text{Mean Percent Score} = \frac{\text{Total Obtained Score}}{\text{Maximum Obtainable Score}} \times 100$$

In the subsequent phase, the Ranking Technique developed by Garrett was employed to determine the principal factors. This statistical method serves to systematically rank a collection of factors according to the preferences expressed by respondents (Dhananjaya et al. 2020). It is frequently employed in agricultural research and extension to assess and prioritize a range of issues, challenges, or solutions, all grounded in the perspectives of farmers. It transforms the ranks assigned by respondents into scores, thereby facilitating the prioritization of factors and the extraction of significant insights.

$$\text{Percent Position} = \frac{(R_{ij} - 0.5) \times 100}{N_j}$$

Where, R_{ij} = Ranked the i th factor by the j th individual

N_j = Count of items evaluated by the j th individual

The transformation of percentage positions into scores is accomplished by referring to the table presented by Garrett and Woodworth (1969). Subsequently, for each factor, the scores assigned to each individual were aggregated, followed by the computation of the total score and the mean values of the scores. The mean scores for all factors were systematically

organized in descending order, allowing for the identification of the most influential factors through the assignment of ranks. The elements exhibiting the highest mean value were considered the most consequential.

3. RESULTS AND DISCUSSION

Following the data collection in the initial phase, the MPS was computed based on the scores provided by the respondents. In order to evaluate the severity of constraints, the average percentage score for each item was computed and subsequently ranked (Natwadia et al., 2023). Table 1 presents 18 statements, accompanied by the MPS, having been meticulously shortlisted from a total of 59 statements across the 9 major areas. The following 18 statements represent the leading two for each of the nine major factors.

It was found that within the Technical Skills and Knowledge domain, the constraints include the untimely provision of knowledge (66.06), where delays in knowledge delivery hinder its relevance, and insufficient skill training (71.24), with farmers expressing a need for more comprehensive technical training. The Entrepreneurial Skill domain reveals issues such as no backward and forward linkages with the market (70.55), which limits farmers' access to inputs and markets, and less promotion for organizing farmers' producers' groups (71.48), underscoring the lack of support for collective action that could enhance farmers' bargaining power. In the Social Skill domain, the constraints include no encouragement for social capital building (71.45), showing a deficiency in fostering networks and trust within farming communities, and poor leadership development training (72.36), highlighting the lack of initiatives aimed at empowering farmers to take leadership roles. Within Adoption of Innovation, the challenges of

recommended practices requiring high investment (72.03) and the level of technology used in the field being adjusted with respect to field condition and investment capacity (71.03) suggest that financial constraints limit the widespread adoption of new practices and technologies. The Access to Improved Services domain includes poor communication from service providers (70.43) and poor awareness about the type and level of improved services to be accessed (71.22), pointing to communication breakdowns and insufficient awareness of available resources. In the Empowerment domain, poor awareness creation by EAS towards type and level of empowerment (70.88) and a casual approach from EAS towards empowerment issues (72.29) reflect a lack of focus on empowering farmers and raising awareness about the opportunities for empowerment. The Economic Resilience domain reveals poor communication from EAS regarding economic resilience (66.31) and no behavioural change suggested that can promote economic resilience (67.00), indicating a failure to communicate strategies for building financial stability and resilience to economic shocks. In

the Social Well-Being domain, the constraints of not promoting group cohesion and group formation (67.66) and not being helpful to build social capital (70.01) highlight the lack of efforts to foster social bonds and collective action that are crucial for community resilience. Finally, the Environmental Integrity domain includes very little orientation provided by EAS regarding environmental integrity (69.46) and promotion of collective work towards environmental integrity is not done by EAS providers (70.32), pointing to insufficient guidance on sustainable practices and collaboration for environmental protection. Together, these findings indicate a broad range of challenges, particularly related to communication, market integration, skill development, empowerment, and sustainability (Zinzala et al. 2019, Rajput et al. 2023). The constraints reflect significant gaps in how Agricultural Extension Services are designed and delivered, underscoring the need for more targeted, efficient, and responsive services that can better address farmers' needs, foster innovation, and support long-term economic, social, and environmental sustainability.

Table 1. Factors along with mean percent score

Major Factors	Statements	MPS
Technical Skills and Knowledge	Untimely provision of knowledge	66.06
	Insufficient skill training	71.24
Entrepreneurial skill	No backward and forward linkages with market	70.55
	Less promotion for organizing farmers producers' group	71.48
Social Skill	No encouragement for social capital building	71.45
	Poor leadership development training	72.36
Adoption of Innovation	Recommended practices require high investment	72.03
	Level of technology used in the field is adjusted with respect to field condition and investment capacity	71.03
Access to Improved services	Poor communication from service providers in this regard	70.43
	Poor awareness about the type and level of improved services to be accessed	71.22
Empowerment	Poor awareness creation by EAS towards type and level of empowerment	70.88
	Casual approach from EAS towards empowerment issues	72.29
Economic Resilience	Poor communication from EAS regarding economic resilience	66.31
	No behavioral change suggested that can promote economic resilience	67.00
Social Well Being	Not promoting group cohesion and group formation	67.66
	Not helpful to build social capital	70.01
Environmental Integrity	Very less orientation provided by EAS regarding environmental integrity	69.46
	Promotion of collective work towards environmental integrity is not done by EAS providers	70.32

Table 2. Ranking of constraints faced in Odisha: (Garret ranking)

Category	Statements	Mean Garret Score	Garret Rank
Technical Knowledge and Skill	Untimely provision of knowledge	70.84	XVIII
	Insufficient skill training	76.02	VI
Entrepreneurial Skill	No backward and forward linkages with market	75.33	X
	Less promotion for organizing farmers producers' group	76.26	IV
Social Skill	No encouragement for social capital building	76.23	V
	Poor leadership development training	77.14	I
Adoption of Innovation	Recommended practices require high investment	76.81	III
	Level of technology used in the field is adjusted with respect to field condition and investment capacity	75.81	VIII
Access to Improved Services	Poor communication from service providers in this regard	75.21	XI
	Poor awareness about the type and level of improved services to be accessed	76.00	VII
Empowerment	Poor awareness creation by EAS towards type and level of empowerment	75.66	IX
	Casual approach from EAS towards empowerment issues	77.07	II
Economic Resilience	Poor communication from EAS regarding economic resilience	71.09	XVII
	No behavioural change suggested that can promote economic resilience	71.78	XVI
Social Well Being	Not promoting group cohesion and group formation	72.44	XV
	Not helpful to build social capital	74.79	XIII
Environmental Integrity	Very less orientation provided by EAS regarding environmental integrity	74.24	XIV
	Promotion of collective work towards environmental integrity is not done by EAS providers	75.10	XII

After the selection of the 18 statements, the ranking technique developed by Garrett was employed, with the Ranks and Mean Garrett Score presented in Table 2. The transformation of the percentage position for each rank into scores was executed using Garret's table. The scores provided by individual respondents for each constraint were compiled and then divided by the total number of respondents who contributed to those scores. The Mean Garrett score for each constraint was systematically organized in a ranked order. The table presents 18 constraints identified across 9 key domains, with the corresponding mean Garrett scores and ranks, shedding light on the major issues that farmers face regarding Agricultural Extension Services (EAS). Within Technical Knowledge and Skill, the constraints include untimely provision of knowledge (70.84), ranked XVIII, reflecting the

delayed delivery of crucial information that undermines its applicability. Similar findings were highlighted in the study by Anderson and Feder (2004), which emphasized that delayed knowledge provision leads to reduced effectiveness in agricultural practices. The second constraint, insufficient skill training (76.02), ranked VI, shows the gap in training programs, with farmers reporting a lack of adequate technical development. This resonates with Davis (2008), who similarly notes that inadequate training is a major barrier to improving farmers' productivity and innovation. Furthermore, Hameed & Sawicka, (2023) in their study on agricultural extension in sub-Saharan Africa highlighted that Both the quality of the material and the skill of extension workers are extremely important; insufficient training can lead to poor communication and unsuccessful

outreach. In the Entrepreneurial Skill domain, no backward and forward linkages with the market (75.33), ranked X, indicates a lack of market integration that restricts farmers' access to inputs and outputs. This is aligned with Ma et al. (2024), who found that it is essential for farmers to participate in the market in order to improve their well-being, increase their income, and reduce poverty. It has been demonstrated through research that selecting the appropriate marketing channels, such as e-commerce, may considerably boost the earnings of farmers and their visibility in the market. Additionally, less promotion for organizing farmers' producers' groups (76.26), ranked IV, highlights inadequate support for collective action, which limits farmers' bargaining power. This constraint resonates with Davis (2008), who emphasized the role of farmer groups in improving market access and achieving economies of scale. Within the Social Skill domain, no encouragement for social capital building (76.23), ranked V, points to insufficient efforts to foster networks and trust among farmers. This finding is echoed by Anderson & Feder (2004), who found that social capital plays a critical role in successful agricultural development. Similarly, poor leadership development training (77.14), ranked I, reveals the need for leadership programs to enable farmers to take on leadership roles in their communities. This is consistent with Davis (2008), who argued that leadership development is essential for enhancing community-based agricultural initiatives. Furthermore, Madu & Wakili (2013) note that leadership training in agricultural extension significantly influences the empowerment of rural farmers. In Adoption of Innovation, recommended practices require high investment (76.81), ranked III, underlines the financial barriers to adopting modern farming techniques. Similar findings are noted by Masi et al. (2023), who discuss The use of precision agriculture technologies, including variable rate technology, is impeded by their capital-intensive characteristics. A multitude of farmers regard these technologies as intricate and economically unattainable. Additionally, level of technology used in the field is adjusted with respect to field conditions and investment capacity (75.81), ranked VIII, indicates that technology adoption is tailored to the financial capacity and conditions of farmers, which might limit full-scale innovation. Studies like those by Anderson and Feder (2004) have similarly pointed out that the adoption of technology is often hindered by farmers' financial constraints. Within the Access to Improved Services domain, poor communication from

service providers in this regard (75.21), ranked XI, points to communication breakdowns between service providers and farmers, which is widely reported in the literature. A similar finding is presented by Ajani and Onwubuya (2013), who identified in Anambra State, Nigeria, inadequate communication skills among extension agents hinder their capacity to interact successfully with farmers. This is exacerbated by inadequate educational achievement and cultural disparities, which require focused training and skill enhancement. Additionally, poor awareness about the type and level of improved services to be accessed (76.00), ranked VII, reflects that farmers are not well-informed about the services available to them, a finding supported by Davis (2008), who noted that farmers' lack of awareness of available services significantly affects their agricultural outcomes. In Empowerment, poor awareness creation by EAS towards type and level of empowerment (75.66), ranked IX, highlights a lack of focus on educating farmers about empowerment opportunities. This is similar to findings by Anderson and Feder (2004), who emphasized that empowerment through extension services is often neglected. Additionally, casual approach from EAS towards empowerment issues (77.07), ranked II, reveals that empowerment is not treated with the seriousness it deserves by extension agents. This echoes findings from Davis (2008), which indicate that extension services often lack a comprehensive approach to empowerment, limiting their potential impact. Within Economic Resilience, poor communication from EAS regarding economic resilience (71.09), ranked XVII, and no behavioural change suggested that can promote economic resilience (71.78), ranked XVI, both suggest that extension services are failing to communicate key strategies for building economic resilience, which is consistent with Anderson & Feder (2004), who noted that communication about resilience-building strategies is often weak in extension services. In the Social Well-Being domain, not promoting group cohesion and group formation (72.44), ranked XV, and not helpful to build social capital (74.79), ranked XIII, reflect the insufficient focus on fostering collective action and strengthening community ties, which are essential for long-term agricultural sustainability. These findings align with Gedikoğlu & Parcell, (2024), who argued that one of the most important factors that contributes to the success of agricultural endeavours is social capital, which is achieved via the formation of relationships and the collaboration of individuals. Farmers in the Konya

Table 3. Major constraints prioritized

Rank	Odisha	
	Domain	Factors
1	Social Skill	Poor leadership development training
2	Empowerment	Casual approach from EAS towards empowerment issues
3	Adoption of Innovation	Recommended practices require high investment

region of Turkey who made investments in social capital were more inclined to participate in communal efforts. This highlights the significance of individual contributions to the overall success of the group. Finally, within Environmental Integrity, very little orientation provided by EAS regarding environmental integrity (74.24), ranked XIV, and promotion of collective work towards environmental integrity is not done by EAS providers (75.10), ranked XII, highlight the lack of emphasis on environmental education and collaborative environmental initiatives among farmers. This finding is consistent with the literature, such as the study by Davis (2008), which stressed that environmental sustainability is often overlooked in agricultural extension efforts, particularly in rural areas. Similarly, Ardoin et al., (2022) discussed the importance of Collective environmental literacy encompasses the comprehension and resolution of sustainability challenges within communities, highlighting the importance of shared resources and dynamic processes. These studies collectively underscore the importance of addressing gaps in communication, training, empowerment, and collective action, all of which are essential to improving the effectiveness of Agricultural Extension Services and promoting sustainable agricultural practices.

The study in Odisha identified three major constraints in Agricultural Extension Services (EAS). First, poor leadership development training under the Social Skill domain was ranked as the top constraint, highlighting the lack of effective leadership programs that hinder farmers' ability to lead and drive community-based agricultural initiatives. Second, the casual approach from EAS towards empowerment issues was identified as a critical issue in the Empowerment domain, indicating insufficient focus on empowering farmers with the knowledge and tools they need to make informed decisions. Finally, the high investment required for adopting recommended practices ranked third in the Adoption of Innovation domain, reflecting the financial barriers that prevent farmers from adopting new, more productive farming methods.

These constraints suggest the need for enhanced leadership training, greater empowerment, and better financial support for innovation in the region.

4. CONCLUSION

This study emphasizes the significant limitations encountered by farmers in Odisha about Agricultural Extension Services (EAS), which impede agricultural productivity and sustainable development. The findings delineate significant issues across various domains, encompassing Technical Knowledge and Skill, Entrepreneurial Skill, Social Skill, Adoption of Innovation, Access to Enhanced Services, Empowerment, Economic Resilience, Social Well-Being, and Environmental Integrity. The primary restrictions identified are inadequate timely information delivery, insufficient skills training, and ineffective communication from service providers. Furthermore, budgetary limitations and the inadequate promotion of collective action and environmental integrity intensify these issues. Nevertheless, the study identifies three principal constraints that exert the most considerable influence on the region: inadequate leadership development training in the Social Skill domain, a lax attitude from EAS regarding empowerment issues, and the substantial investment necessary for implementing innovative practices. These findings highlight the pressing necessity for a thorough and targeted strategy to enhance leadership training, equip farmers with essential resources and expertise, and mitigate financial obstacles to the adoption of innovation. Mitigating these obstacles will be essential for improving the efficacy of Agricultural Extension Services and promoting sustainable agricultural growth in Odisha.

5. POLICY IMPLICATIONS

Several critical policy implications can be derived for enhancing Agricultural Extension Services (EAS) in Odisha. Policymakers should prioritize the establishment of leadership development programs to empower farmers and extension

agents. Secondly, empowerment initiatives must be enhanced by equipping farmers with technical, decision-making, and entrepreneurial skills. To mitigate the financial impediments to innovation, it is essential to implement subsidies, micro-financing, and cost-effective technology. Furthermore, enhancing communication and information exchange between service providers and farmers is essential, as is the promotion of farmer producer organizations (FPOs) to improve market access and facilitate collective action. Environmental sustainability must be incorporated into EAS by promoting environmentally responsible agricultural practices. Finally, focused interventions for women and underprivileged farmers are essential to guarantee inclusion and equitable development. These policy measures will facilitate the establishment of a more efficient, inclusive, and sustainable agricultural extension system in Odisha.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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