Impact Assessment of Climate Change Knowledge Network in Indian Agriculture (CCKN-IA) of selected blocks of Jharkhand, Maharashtra and Odisha States

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Abstract

The study on Impact Assessment of Climate Change Knowledge Network in Indian Agriculture (CCKN-IA) is an ex-post impact evaluation study that intended to establish comparative learnings such that the CCKN–IA approach could be easily replicated across blocks of the entire state. The CCKN project was implemented in three states namely Jharkhand, Odisha and Maharashtra during 2015 – 2017. The study focuses on the extent of access to climate adaptive advisories, from the responses of the project and control farmers. It is found that the project farmers had higher access to climate adaptive advisories than control village farmers in crop production practices. As far as the adoption of climate adaptive advisories are concerned, the farmers of project villages in all the three states reported a higher adoption of climate adaptive advisories in crop production than that of the control villages. Assuming the project benefits in the pilot blocks, the same concept of CCKN-IA project can be upscaled. Accordingly the cost of implementation has been worked out and presented in this paper, so that the respective State Governments can adopt the CCKN-IA project in the entire state.

Key words: climate change, agriculture, knowledge network, CCKN, climate adaptive advisory

Introduction

Agriculture in India, continues to provide livelihood to more than half of the country's population and has been transforming itself from being a mere way of life to "Smart", with improved precision across the supply chain operations. However, the sector continues to be characterized inherently "risky" and typical due to multiple reasons including fragmentation of landholdings, associated high risk production conditions, perishability of produce, output price variations, etc. In addition to the commonly cited risks, Climate Change plays a major deterrent

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impacting the food and fodder production activities across the globe, seeking the attention of policy makers, researchers and development organizations. It is known that "Climate Smart Agriculture (CSA)" is one of the key focus areas of research for the scientists and academicians, world-wide.

Information Technology (IT) enabled delivery of agricultural information and advisory services to the farmers is being widely talked about and piloted in various forms in the country. It is in the fitness of things to integrate climate change knowledge delivery with such existing networks. "Effective engagement of stakeholders and management of knowledge for adaptation is vital in supporting all adaptation activities, at each step in the process" (United Nations Framework Convention on Climate Change). Communication and capacity building have significant roles in fostering large scale and effective adaptation to climate change. While creation of such knowledge and building capacities of the stakeholders is a demanding task, sustaining the process of creation and knowledge delivery is of equal and paramount importance.

Climate Change Knowledge Network in Indian Agriculture (CCKN-IA)

The project, "Climate Change Knowledge Network in Indian Agriculture" (CCKN – IA) was implemented by the National Institute of Agricultural Extension Management (MANAGE), Ministry of Agriculture and Farmers Welfare (MoAFW), Government of India (GoI) with technical cooperation of Deutsche Gesellschaftfür Internationale Zusammenarbeit (GIZ), an enterprise owned by the German Government. The project is described to be one of its kind and innovative in addressing the knowledge and information needs of the farmers in adopting agricultural and allied production practices for effective adaptation towards climate change and its adverse impacts. The project was grounded and reached out to the farmers from 2015 through 2017. The CCKN-IA project was implemented in three states of Jharkhand, Maharashtra and Odisha, covered 12 blocks and 96 villages. Project districts included Pune and Ahmednagar of Maharashtra, East Singhbhum and Ranchi of Jharkhand andGanjam and Dhenkanal of Odisha.

The primary objective of the CCKN-IA programme was to develop a robust network of information exchange systems to effectively share knowledge across the gamut of stakeholders in the project area. This is to ensure improved access to updated, timely, authentic and location specific information that enables the farmers, extension service providers and policy makers get better equipped to

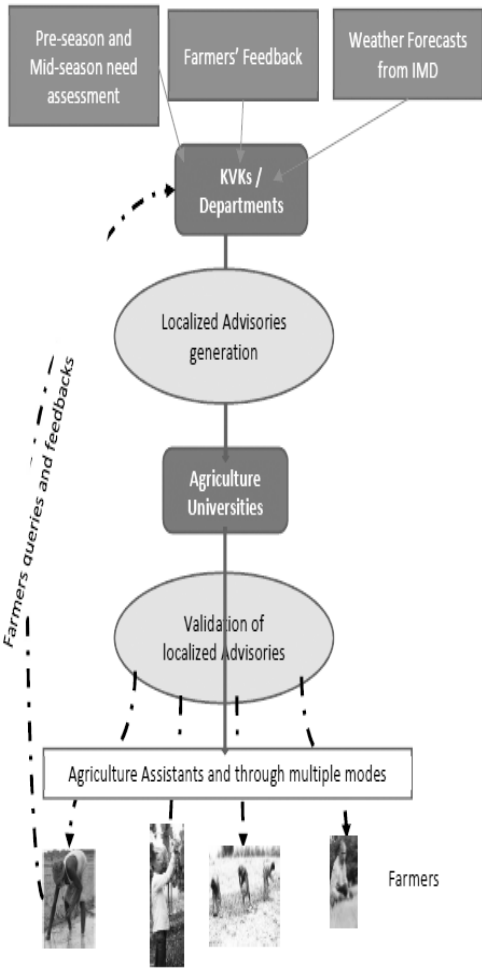
adapt to climate change. Such collaborative efforts contribute towards innovative ways to meet the real-time farmers' needs and providing a multi-modal two-way exchange process.

GIZ and MANAGE have been successfully implementing the network based localized advisory processes using the digital tool called NICE (Network for Information on Climate Exchange) System. The project Climate Change Knowledge Network in Indian Agriculture (CCKN-IA) was successfully piloted in the select locations in the states of Jharkhand, Maharashtra and Odisha. The quality advisory generation, validation and delivery processes are anchored and institutionally supported by MANAGE in partnership with State Agricultural Universities (SAUs) and Krishi Vigyan Kendras (KVKs).

NICE System

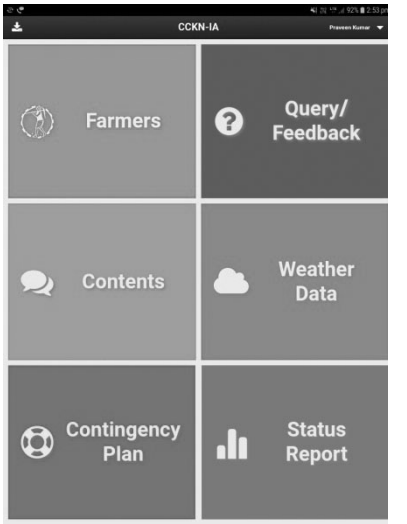
The Network for information on Climate (EX) change (NICE) is a web-based open source platform, that allows a multimodal approach and enables two-way communication to link farmers' needs to knowledge experts on a real time basis. The farmers receive the advisories through SMS, field agents also use tablets to disseminate advisories to farmers thereby creating a more personal link. NICE has some remarkable features for successful collation, validation and dissemination of advisory information. The modular structure of NICE allows a peer-review mechanism from content aggregation, expert validation and subsequent translation and dissemination of the content. Finally the content created on NICE is disseminated to the farmers. The NICE system has the facility to capture the farmer's basic and socio-economic details including, land details, crops grown for the season etc.

Using NICE system, the expert can send advisory to the farmers in multi-modal approach i.e. not only in the form of SMS but also through Posters, Video URL, documents etc. The content other than SMS will be delivered to the Tablet of Field Agents. This content is further disseminated to the farmers by the Field Agents in the village. The farmers get timely, authentic advisory messages and the content is generated based on their local needs i.e. fully localized content is generated by the experts. This helps the farmers to adopt the advisories sent by the experts. The field agents also play an important role in disseminating the advisories to the farmers using mobile app on TAB. The posters, video URL, and documents helped the farmers to know more details of the advisory.



Knowledge Management process under CCKN-IA

The NICE+ mobile was developed under CCKN-IA project for the Field. This mobile app works only in combination with a specific web solution developed for the project and is only accessible for registered Field Agents. Relevant information is collected in a decentralised process, through this app and the backend system. The Mobile App enables Field Agents in creating and updating farmer profiles, land details and crop details from the village itself. The farmers can also access the information related to weather forecasting, the advisory content (SMS/Posters/ Video links etc) and contingency plans uploaded for their blocks. The Field Agents can upload the farmers' field query with crop photos to the domain expert and can also see the expert advice on the farmers query.



The key players involved in content generation, validation and dissemination process are State University Scientists, KVK scientists, and the field functionary. The feedback from the field level functionary is assessed and based on the need and requirement, the content is generated by the KVK subject matter experts. The generated content is validated by the university scientists of the same knowledge domain division and the content is approved. The validated content is disseminated to the farmers and field agents in the form of SMS service. The farmer queries, which are received from the field agents for a specific farmer or the entire village, are taken up by the subject experts and the query is resolved. The resolved query advise is sent to the farmer and also to the field agents.

Impact Assessment

The study on Impact Assessment of Climate Change Knowledge Network in Indian Agriculture (CCKN-IA) is an ex-post impact evaluation study that intended to establish comparative learning such that the CCKN – IA approach can be easily replicated across blocks and locations of all the states in the country.

Objectives of the study

- To conduct a comparative analysis in the project blocks, comparing the project villages with nearby non-project villages in the blocks.
- To share the findings on key promoting factors as well as gaps and challenges that are needed to be addressed to use CCKN-IA approach in the non-project villages and thus recommend needed adaptations and inputs for scale-up.

Research Methodology

The impact assessment had primarily employed quasi-experimental method; Propensity Score Matching (PSM) to compare the beneficiaries or project farmers and non-beneficiaries or control farmers on various production related variables. It is believed that the beneficiaries and the non-beneficiaries will have the same level of access to the other development programs of the state and central governments

while choosing the method. Propensity score matching technique employed in the selection of sample ensures that the impacts of CCKN-IA are delineated, in other words, the method leads to assessment of the impact of CCKN-IA alone.

Sampling

The survey design was formulated such that random selection of project villages in the 12 project blocks across 6 districts was carried out. The control villages were chosen such that they have similar agro-climatic conditions, socio economic condition of living, cropping patterns, access to agricultural inputs, markets, extension systems etc. as that of the project villages, and are not impacted with any spill-over benefits from the project. Accordingly, 12 project villages and 12 control villages across the 12 project blocks of 6 districts of three states were chosen for the survey. The details of the sample project and control villages are shown in the Table 1.

Table 1. Details of sample Project and Control Villages under each Block of CCKN-IA Project Area

States (3)	Districts (6)	Blocks (12)	Project Villages (12)	No.of farmers - Project village	Control Villages (12)	No.of farmers -Control village
Jharkhand	East Singhbhum	Patamda	Beldih	18	Dogrigora	5
		Boram	Muchidih	18	Chimti	5
	Ranchi	Angara	Navagarh	18	Maheshpur	5
		Ormanjhi	Hendebilli-Kulhi	18	Dhakjiban	5
Maharashtra	Pune	Velha	Ambavane	18	Karan jawane	5
		Junnar	Agar	18	Alu	5
	Ahmednagar	Nagar	Khandala	18	TakaliKhatgaon	5
		Rahata	PimpriLokai	18	Adgon Bk	5
Odisha	Ganjam	Chhatrapur	Kanamana	18	Laxmipur	5
		Sanakhemundi	Pattapur	18	Balia	5
	Dhenkanal	Dhenkanal Sadar	Harekrushnapur	18	Fatkei	5
		Kankadahad	Tariniposi	18	Chandapur	5
			TOTAL	**216**	**TOTAL**	**60**

Beneficiary farmers for the study were chosen randomly from the project villages. Assuming that the beneficiary farmers constitute a simple random sample of a population of similar subjects, a sample of 216 beneficiary farmers were chosen randomly from the project villages for the survey (total registered farmers under the project are 24,162). In case of control farmers, 28 per cent (60 farmers) of the project sample were interviewed from control villages. Thus a total of 276 farmers were surveyed in the project and non-project villages. The above sample was uniformly distributed across the project states, districts and villages.

Results and Discussion

Demographic profile of the respondents

Among the beneficiary and non-beneficiary farmers, 53 per cent of the respondents belong to the middle age group of 31 to 50, 32 per cent of them are more than 50 and 15 per cent of them belong to the age group of 21-30. The mean age of the farmers interviewed was 45.1. The age of the respondents from project and control villages is shown below.

Table 2. Age Group of Respondents

S.No.	Age Group	Farmers Interviewed (%)
1.	21 – 30 years	15%
2	31- 50 years	53%
3.	Above 50 years	32%

Landholding

Among the farmers interviewed, 37 per cent are marginal farmers with landholding below 2.5 acres, 43 per cent are small with landholding between 2.5 acres and 5 acres and 16 per cent are large farmers with landholding of above 5 acres. Date on landholding wise farmers interviewed for the study is shown below.

Table 3. Land holding wise farmers interviewed

S.No.	Land holding	Farmers Interviewed (%)
1.	Marginal (below 2.5 acres)	37%
2	Small (2.5 – 5.0 acres)	43%
3.	Large (above 5 acres)	16%

Access to Crop Advisories by Farmers

1. Extent of access to Climate Adaptive Advisories on Crop Production

The farmers of the project villages and control villages were required to give their responses on their access to climate change advisories pertaining to crop production on a five-point continuum ranging from 'Very high' access to 'Very Low' access [Very High denoting 5, High is 4, Medium is 3, Low is 2 and Very Low indicating 1]. Land Preparation, Selection of Crops and Varieties, Time of Sowing, Seed rate, Nursery Management, Transplanting, Water Management, Nutrient Management, Pest and Disease Control, Preventive Advisories on Crop Pests and Diseases, Harvesting and Post-Harvest Management are the advisories on which the data was enumerated as part of the field survey.

The data in Table 4 below shows the impact of CCKN on the access to climate change advisories on different aspects of crop cultivation from land preparation to post harvest management.

Table 4. Extent of Access to Climate Adaptive Advisories – Crop Production – Mean Access Score

Components of Crop Cultivation	Control / Project	States (maximum possible score =5)			
		Jharkhand	Maharashtra	Odisha	Total
		Mean	Mean	Mean	Mean
Land Preparation	Control	2.71	2.33	2.18	2.43
	Project	3.34	3.61	3.30	3.40
Selection of Crop / Variety	Control	2.90	2.40	2.35	2.58
	Project	3.42	3.69	3.20	3.41
Time of Sowing	Control	2.33	2.33	2.41	2.36
	Project	3.44	3.56	3.41	3.46
Seed Rate	Control	2.24	2.20	2.06	2.17
	Project	2.87	3.33	3.06	3.07
Nursery Management	Control	2.43	2.27	1.94	2.23
	Project	2.94	3.39	3.01	3.09
Transplanting	Control	2.52	2.27	2.12	2.32
	Project	3.03	3.23	2.93	3.05
Water Management	Control	2.52	1.73	2.00	2.13
	Project	2.99	3.25	3.03	3.07
Nutrient Management	Control	2.29	1.67	1.82	1.96
	Project	3.14	3.54	2.70	3.09

Components of Crop Cultivation	Control / Project	States (maximum possible score =5)			
		Jharkhand	Maharashtra	Odisha	Total
		Mean	Mean	Mean	Mean
Pest and DiseaseControl	Control	2.19	1.40	1.94	1.89
	Project	3.34	3.56	2.98	3.27
Preventive advisories on crop pests and diseases	Control	1.86	1.27	1.65	1.62
	Project	3.04	3.38	2.76	3.03
Harvesting and post-harvest	Control	2.00	1.40	1.76	1.75
	Project	2.84	3.05	2.83	2.89

The data shows that the farmers of project villages in all the three states; Jharkhand, Maharashtra and Odisha have reported a higher access to climate adaptive advisories than that of control villages. The project villagers had received their advisories through multimedia such as SMS, one page leaflet, village notice boards and farmer meetings.

The mean advisory access score for different aspects of crop cultivation ranged from 2.89 to 3.4 (out of a maximum score of 5.00) in case of project villages of three states pooled together and the range was 1.62 to 2.43 in case of control villages.

The study further revealed that in case of project villages (pooled), the access to advisories was highest in case of time of sowing (score 3.46) followed by selection of crops and varieties (3.41), land preparation (3.40), control of pests and diseases (3.27), plant nutrient management (3.09), nursery management (3.09), seed rate (3.07), water management (3.07), transplanting (3.05), preventive advisories (3.03) and harvesting (2.89).

2. Institutional Support

In CCKN-IA project villages, the network of institutions has been established with scientists of KVK, State Agricultural Universities and Extension functionaries very strongly. The field level problems are accessed by the extension functionary with the help of Field Agents at the village level and reported to the KVK scientists for the advisory on field problems. The advisory content is generated by KVK scientists and validated by SAU scientists. The validated advisories are disseminated to the farmers.

The farmers of project villages and control villages were required to give their responses on their access to institutional support for climate adaptive advisories on a five-point continuum ranging from 'Very high' access to 'Very Low' access [Very High denoting 5, High is 4, Medium is 3, Low is 2 and Very Low indicating 1]. CCKN -IA, Extension Agents, Self Help Groups (SHGs)/ Farmer Producer Organizations (FPOs), Financial support, Market information, Weather information, Crop/ Animal Insurance are the types of institutional support on which the data was enumerated as part of the field survey. The data in Table 5 below shows the impact of CCKN on the access to institutional support and services.

Table 5. Impact of CCKN on the Access to Institutional Support and Services

Institutional Support and Services	Control / Project	States (maximum possible score =5)			
		Jharkhand	Maharashtra	Odisha	Total
		Mean	Mean	Mean	Mean
CCKN IA	Project	4.22	3.56	3.69	3.84
	Control	1.38	1.27	1.24	1.3
Extension Agents	Project	3.05	3.93	3.41	3.43
	Control	2.95	2.47	3.06	2.85
SHG/ FPO	Project	2.67	3.15	2.7	2.81
	Control	2.29	1.53	1.76	1.91
Financial Support	Project	2.7	2.52	2.45	2.56
	Control	2.29	1.27	1.76	1.83
Market Information	Project	3.09	3.31	2.43	2.91
	Control	2.48	1.53	2.12	2.09
Weather Information	Project	3.09	3.72	2.69	3.12
	Control	2.48	1.8	1.65	2.02
Crop/ Animal Insurance	Project	2.4	3.26	2.33	2.61
	Control	2.29	1.87	1.88	2.04

The data show that the farmers of project villages in all the three states namely Jharkhand, Maharashtra and Odisha have reported a higher access to institutional support and services than that of control villages.

The mean advisory access score for different aspects of institutional support ranged from 2.56 to 3.84 (out of a maximum score of 5.00) in case of project villages of three states pooled together and the range was 1.3 to 2.85 in case of control villages.

Futuristic Perspective – Replication

The study result shows that the project benefits would sustain moderately given that the climate adaptive practices recommended by the project are profitable to the beneficiary farmers. The study also shows that the adoption of advisory services by farmers in the CCKN-IA project was high. When farmers experienced significant yield improvement, it is likely that they would adapt the farm management practices in a continuous manner and also refer to fellow farmers in their vicinity. Hence, it can be inferred that the sustainability of the project depends on the commercial performance of the climate adaptive practices disseminated at the farm level.

It is important to look at the project benefits if the same concept is replicated in similar geographies. The CCKN-IA project can be upscaled based on its successful implementation in the selected blocks of the three states. One of the crucial assumptions is that the NICE portal developed under the CCKN-IA project would continue to anchor the knowledge dissemination activity in the newly replicated locations also.If the project is to be replicated in similar geographies across the country, estimated cost at the block level is shown in Table 6.

Table 6. Estimated Costs for replication in a block (1) – CCKN IA

Component	Indicative Budget for a block- Recurring costs per annum (Rs)
Salaries of Project Staff (A)	
Engagement of Extension Officer at the block level @ Rs. 15,000 per month	180000.00
Engagement of village level extension officers at the village level (5 officers @ Rs. 8,000 per month)	480000.00
Engagement of KVK resources for preparation of climate adaptive advisories (consolidated)	50000.00
Travel and Related costs (B)	
Travel costs @ Rs. 3,000 per month for Block level officer	36000.00
Travel costs (for 5 officers @ Rs. 2,000 per month) for village level extension officer	120000.00
Communication costs (C)	
Cost of Tablets (6 Nos @ Rs. 7000 per device)	42000.00
Mobile allowance along with data packs for 6 people (@ Rs. 300 per month)	21600.00

Component	Indicative Budget for a block- Recurring costs per annum (Rs)
Other operational expenses (D)	
Farmer meetings	20000.00
Exposure Visits	20000.00
Grand Total (A+B+C+D)	**969600.00**

Based on the assumptions from the field, the total estimated cost of replication of the project (operational cost) in similar blocks is Rs. 9.69 lakhs (Table 6). However, to keep the costs nominal, the existing resources of the public extension systems in the States could be leveraged. The project could only absorb the costs towards travel, communication and promotional expenditure including farmer meetings and exposure visits. Accordingly, the total estimated cost of replication is Rs. 2.59 lakhs per block, as detailed in Table 7.

Table 7. Estimated costs for replication in a block (2) – CCKN IA (using existing resources of the public extension systems in the States)

Component	Indicative Budget for a block- Recurring costs per annum (Rs)
Travel and Related costs (A)	
Travel costs @ Rs. 3,000 per month for Block level officer	36,000.00
Travel costs (for 5 officers @ Rs. 2,000 per month) for village level extension officer	120,000.00
Communication costs (B)	
Cost of Tablets (6 Nos @ Rs. 7000 per device)	42,000.00
Mobile allowance along with data packs for 6 people (@ Rs. 300 per month)	21,600.00
Other operational expenses (C)	
Farmer meetings	20,000.00
Exposure Visits	20,000.00
Grand Total (A+B+C)	**259,600.00**

Limitations of the Study

The impact study on Climate Change Knowledge Network in Indian Agriculture (CCKN-IA) has certain limitations; 1. As the implementation of CCKN-IA project in the selected pilot blocks was completed, the personnel associated at the project locations were moved out of the project activities. The availability of detailed

information was limited. 2. Quantification of impact on yield and returns was not simple as the respondents were reluctant. 3. In certain cases, especially in responding to questions on crop yields, gross returns and net returns, it has been observed that there is a general tendency to under report.

Conclusion

The overall picture regarding access to climate change advisories on crop cultivation shows that the CCKN project has resulted in increased diffusion of climate change advisories among the farmers of the project area as compared to farmers of control villages who had significantly lower level of access. Thus, it can be concluded that the extension efforts of CCKN project have a significant impact on diffusion of climate change advisories on crop cultivation among the farmers of the project area. The results of institutional support and services of CCKN IA project interventions show that the project farmers had increased access to the support and services that led to dissemination of knowledge on climate change. It can be inferred that the functioning of these support systems and services were more effective in case of project villages as compared to the control villages.

Given that the project farmers had distinctly benefitted from the project interventions as compared to the control farmers and climate adaptation is a continuous process, it is strongly suggested that the project efforts are sustained and scaled up across the three states namely Jharkhand, Maharashtra and Odisha for realizing long term benefits. In order to realize benefits at an aggregate level, replication can be undertaken across similar regions and geographies where the climate change adaptation is essential and challenging. Priority programs by the agriculture departments of states can draw synergies with the project architecture in general and NICE portal in particular, suitably.

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