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ROLE OF PUBLIC EXTENSION AND ITS EFFECT ON AGRICULTURE PRODUCTIVITY: AN INSIGHT FROM INDIAN NATRUAL RUBBER CULTIVATION

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ABSTRACT

Public extension activities are considered an indispensable part of Indian agricultural strategy. The only way to achieve tremendous progress in production and productivity is through effective adoption of scientific agro-practices among farmers. Government has taken several grass root level initiatives in order to strides the level of adoption of modern innovation in farm fields. This paper analysed the effectiveness of various extension services of Rubber Board of India on productivity enhancement of natural rubber cultivation. The study has taken small natural rubber growers in India. The analysis reveals that the Rubber Board of India has played remarkable role in expansion of production as well as productivity of natural rubber in India.

JEL Classification: Q

INTRODUCTION

The agriculture sector on the globe has been changing significantly and researchers and policymakers have still highlighted its role as its ability to

feeds and it provides a livelihood for millions of people (Pogge, T., & Sengupta, M., 2015) (Alvarado, R., Ortiz, C., Jiménez, N., Ochoa-Jiménez, D., & Tillaguango, B., 2021). According to the World Bank study group, this is considered the most powerful strategy that we can follow to overcome the problem of extreme poverty and boost shared prosperity and feed a projected 9.7 billion people by 2050 (www.worldbank.org, 2020). In most of the developing countries, the key role assigned to public spending and effective institutional intervention where it can fulfill the requirement of the sector and design and validate the agriculture production system (Labarthe, May 2009); (Ashok Gulati, Pravesh Sharma, Anisha Samantara, Prerna Terway, 2018). Both the society and the farmers' level through various agricultural extension services transfers the scientific as well as best practices innovations. This will evolve the revolution of agriculture production and productivity (Chand, R., 2001) (Darko, R. O., Junping Liu, Shouqi Yuan, Sam-Amoah, L. K., & Haofang Yan, 2020).

Extension services played an integral part in agriculture and these activities bridge the gap between the farm field and research as well as technological innovation conducted by various formal as well as informal institutions (Birkhaeuser, D., Evenson, R. E., & Feder, G. , 1991). Thus, the role of institutions in extension activities is an indispensable part of the development of agriculture production as well as productivity. Currently, public extension activities are confronting serious challenges such as ineffective supervision of extension activities, delay in funding, inadequate expertise training and lack of coordination (Anifat Ibrahim and Adedayo Ajayi, 2019); (Jon Hellin & Carolina Camacho, 2017). There were some studies about the operational efficiency as well as the effectiveness of public extension services on agricultural production and productivity. Previous studies have emphasized that inadequate monitoring and lack of funding as the possible reasons for the failure of effective public extension services. In this paper the researcher tries to analyse the performance and effectiveness of government institutions in providing various extension services for the expansion and promotion of agriculture in India.

Rubber Board of India And Natural Rubber Cultivation

Under the British rule originally thought that the rubber tree would not grow in India (Drabble, 1973). The credit for starting the commercial cultivation of Natural Rubber goes to a European planter of Irish stock, John Joseph Murphy. He is known as 'the father of Indian rubber plantation industry' (Froude, 1867). Currently, in the global market India is considered the second largest consumer and also the Asia pacific regions like china and Thailand being the largest consumer, with 60% of global consumption. World natural rubber production during 2020 was fell by 10.098 million tonnes as against 13.842 million tonnes produced in 2019 (ANRPC , November 2020). There is a growing demand for natural rubber in global market.

The tremendous expansion of natural rubber cultivation in India especially in traditional region is because of the active intervention of Rubber Board of India. The introduction of various developmental and extension support of the

Rubber Board marked as a significant landmark in the history of the growth of rubber plantations and allied sectors in India. Since the inception period onwards the Rubber Board has initiated several extension services to farmers in order to induce modernisation of crop processing and also to improve the production and productivity of the crop. As part of the extension services, the Board has concentrated on the improvement of quality of the produced by effective distribution of inputs at a concessional price, supply of planting materials, technology adoption and conduct different levels of training and awareness campaign services. This study has analysed the effectiveness of Board's extension services on productivity enhancement and also examine whether there was a significant difference in mean scores between active and inactive farmers' perceptions of the effectiveness of Rubber Board extension operations on productivity enhancement.

MATERIALS AND METHODS

Rubber is considered an important industrial as well as strategic crop in India (Anuja, A. R., Kar, A., Mathur, V. C., & Jha, G. K., 2012). There was a tremendous progress in the expansion of area under natural rubber cultivation in India (K.G Mohanan and Remesh B. Nair). India surpassed China as the fifth largest producer of natural rubber in 2018, accounting for 4.8 percent of global production, according to the Association of Natural Rubber Producing Countries (ANRPC). In 2018, India also surpassed Vietnam and Thailand to take third position in global productivity (Rubber Board of India, May 2019). The paper has taken small rubber growers of traditional natural rubber growing region of India (the state of Kerala and Kanyakumari District in Tamil Nadu) as respondents of the study. The traditional region especially Kerala has taken for study because which account 81% of production (ANRPC , November 2020). In this study, both primary and secondary data are used for the study. The primary data was collected from natural rubber growing regions of India. The structured questionnaire was used to collect data from growers. The questionnaire included instruments for measuring the extension support of Rubber Board and its effectiveness.

The researcher has chosen traditional natural rubber-growing areas of India for the analysis, which can be divided into three areas: north, central, and south zones. According to the Rubber Board of India's census, there are 1054570 rubber growers in India's traditional rubber growing area (Rubber Board of India, May 2019). In each zone, one district in India's traditional rubber growing region with an elevated density of rubber holdings and comparable agro-climatic conditions was chosen for the analysis. The central zone Kottayam, the south zone Trivandrum, and the north zone Kannur were chosen from India's traditional rubber growing regions. The sample size was computed using the equation given (Krejcie, R. V., & Morgan, D.). $s=\square^2\square\ \square(1-\square)\div\square^2(\square-1)+\square^2\square(1-\square)$.

s=required sample size.

X^2 =the table value of chi-square for 1degree of freedom at the desired confidence interval (3.841).

N=the population size

P=the population proportion (assumed to be .50 since this would provide the maximum sample size).

d= the degree of accuracy expressed as a proportion (.50).

Using Krejcie and Morgan's (1970) equation for identifying the sample size, for a given population of the study constitutes 3, 97,456 rubber growers in the selected districts. It states that at 95 percent level of confidence when the sample size is between 250000 and 500000, the adequate sample size is 384 at 5 percent margin of standard error. The instrument has four factors, which composed of 26 statements. A five-point Likert scale extending from Strongly agree to Strongly disagree was used to measure all four items. Data has been tabulated, analysed and presented using descriptive statistics, exploratory factor analysis and also used one-sample t-test for analysis.

RESULTS

Extension services of the Rubber Board of India is influential in rapid technology adoption and catering to the stakeholders' needs from seed to market (Rajeevan, 2016). They also serve as an agent to deliver modern technological innovation information and also assist to enhance the productivity of the rubber produced in the small holding sector through technical assistance and subsidized distribution of planting material inputs (Thamban, C., Jaganathan, D.,Kalavathi, S.,Anithakumari, P., Chandran, K. P, Jayasekhar, S., 2016).The major core area of extension activities is technological diffusion, reduction cost of production and improvement of the quality of rubber produced and human resource development. This paper analysed the effectiveness of intervention of Rubber Board of India in delivering extension activities in bottom of the pyramid.

Exploratory Factor Analysis of Effectiveness of Extension Activities of The Rubber Board

Table No: 1- Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity -Rubber Board of India's Extension Activities

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.600
Bartlett's Test of Sphericity	Approx. Chi-Square	1782.143
	Df	320
	Sig.	.000

Source: Computed from Primary Data

Above table no:1 shows that the outcome of two tests namely, Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity are used to test whether the relationships among variables are significant or not. Kaiser-Meyer-Olkin Measure of Sampling Adequacy shows the value of test statistics as 0.600 which means factor analysis for selected variables is

appropriate. Bartlett's Test of Sphericity shows the significant value as 0.000, which means the selected variables are statistically significant and exhibit high relationship on the effectiveness of Rubber Board's extension services.

Table No-2 *Rotated Component Matrix*

SlNo:	Factor	Statements of supply of Inputs for cultivation at concessional Price	Factor Loading
EPI1	**Factor 1:** Supply of Input 11.766 % of variance	Supply of planting as well as material inputs at concessional price helped to improve productivity	.718
EPI2		Processing units with subsidy helped us to reduce cost of production	.641
EPI3		Usage of unauthorised input materials without the recommendation of the Rubber Board leads yield loss	.605
EPI5		Inputs supplied by Rubber Board at concessional prices were low in quality forcing us to buy better products from private agencies.	.550
EPI14		Quality of fertilisers distributed by the Board appeared to be poor	.516
EPI6		As per the advisory suggestion timely use of fertilisers reduced the incidences of diseases	.499
EPS7	**Factor 2:** Distribution of planting materials 10. 286 % of variance	Planting with high yielding varieties of sapling enhance productivity	.698
EPS8		There was low availability of Rubber Board certified planting materials	.629
EPS9		Better selection of saplings guarantees consistent growth and yield from the trees	.517
EPS10		Selection of saplings from the Rubber Board certified private nurseries ensures better quality seedlings	.489
EPS11		Subsidy motivates us to use new series clones like RRII 414, 400, 105.	.487
EPS12		Intervention of unauthorised dealers in planting reduces the quality of sapling	.426
EPS13		Better guidance from the Rubber Board help to identify better saplings	.523
EPT13	**Factor 3:** Technology Adoption	Usage of rain guarding ensures better technology adoption	.593
EPT14		Suggested usage of production	.534

	7.699 % of variance	enhancement liquids (ethephon) has led to increase in productivity	
EPT15		Application of Ethephon induces productivity and reduce the cost of cultivation	.496
EPT16		Suggested usage of production enhancement liquids (Ethephon) has led to incidence of diseases.	.453
EPH17	**Factor 4:** Training 7.281% of variance	Training and better guidance from Rubber Board help identify better seedlings from private nurseries	.530
EPH18		Training programmes on adoptionof scientific cultivation are effective.	.505
EPH19		Training on beekeeping helps get additional income	.499
EPH20		Need-based training programmes ensure capacity building	.482
EPH21		Training enhances skill up-gradation for better technology dissemination	.469
EPH22		Suggestions put forth during awareness campaign are not put into practice.	.454
EPH23		Training on usage and selection of new clones helped to adopt better ones.	.432
EPH24		Suggestions coming up during Campaign Programmes are not acceptable.	.417
EPH25		The farmers are not aware of the training programmes conducted by the Rubber Board	.406
Total Variance Explained= 37.022% of Variance			

Source: *Computed from Primary Data*

Table 2 shows that four factors have been extracted from the 26 parameters of the effectiveness of the Rubber Board's extension activities, and these four factors account for 37.022 percent of the total variance. The six input distribution parameters EPI1, EPI2, EPI3, EPI4, EPI5, and EPI6 were grouped together as factor 1 (Supply of Input) with 11.766 percent variance, and another seven Rubber Board extension activities parameters EPS7, EPS8, EPS9, EPS10, EPS11, EPS12, and EPS13 were grouped together as factor 2 (Distribution of Planting Materials) with 10.286 percent variance. Another four Rubber Board extension activities parameters, EPT13, EPT14, EPT15, and EPT16, were combined to form factor 3 (Technology Adoption) with a variance of 7.699 percent, and nine parameters were combined to form factor 4 (Training) with a variance of 7.281 percent. From the above table no:2 loading pattern of the factors has a strong association among the parameters and all the four variables are found to contribute towards the effectiveness of the extension activities of the Rubber Board among rubber growers in India.

DESCRIPTIVE STATISTICS OF THE EFFECTIVENESS OF EXTENSION ACTIVITIES OF THE RUBBER BOARD

Descriptive Statistics on Inputs at Concessional Price

The Rubber Board of India provides planting materials and inputs with the aim of improving rubber yields by changing agricultural practises (Anuja, A. R., Kar, A., Mathur, V. C., & Jha, G. K., 2012). By selling inputs at a subsidised price, the Rubber Board of India raises awareness among farmers about the benefits of adopting or strengthening agricultural practises (Nair, K. P., 2021). Farmers are encouraged to use the most effective practises as a result of this (Suh, D.H.; Moss, C.B., 2021). This has proven to be beneficial in terms of lowering the cost of rubber production. In the long run, net advantage from the effective adoption of inputs will help the farmers to modernise the agricultural practices. The following table shows the descriptive statistics of measurement items of the distribution of inputs.

Table No:3 *Descriptive Statistics on Usage of Inputs at Concessional Price*

Sl No:	Usage of Inputs at Concessional price	Mean	Mean Rank
1	Supply of planting as well as material inputs at concessional price helped to improve productivity	3.80	2
2	Processing units with subsidy helped us to reduce cost of production	3.39	4
3	Usage of unauthorised input materials without the recommendation of the Rubber Board leads yield loss	3.22	5
4	Inputs supplied by Rubber Board at concessional prices were low in quality forcing us to buy better products from private agencies	4.04	1
5	Quality of fertilisers distributed by the Board appeared to be poor	3.10	6
6	As per the advisory suggestion timely use of fertilisers reduced the incidences of diseases	3.70	3

Source: *Computed from Primary Data*

The Mean and Mean Rank Values on Distribution Effectiveness as well as Acceptance of Inputs at Concessional Prices are shown in Table No. 3. It is found that the mean score for first aspect of usage of inputs at subsidised price is 3.80 which means that 'Supply of planting as well as material inputs at concessional price helped to improve productivity', the mean value for the second aspect is 3.39 which means that 'Processing units with subsidy helped us to reduce cost of production, the mean value for the third aspect is 3.22 which means that 'Usage of unauthorised input materials without the

recommendation of the Rubber Board leads yield loss', the mean value for fourth aspects is 4.04 which means that 'Inputs supplied by Rubber Board at concessional prices were low in quality forcing us to buy better products from private agencies, the mean value for the fifth aspect is 3.10 which means that 'Quality of fertilisers distributed by the Board appeared to be poor' and the mean value for the sixth aspect is 3.70 which means that 'As per the advisory suggestion timely use of fertilisers reduced the incidences of diseases'. Hence it can be concluded that the natural rubber growers agree with the view that distribution inputs such as fertilisers and rain guarding equipment at concessional price helped in reducing the cost of production and it will persuade the growers to adopt scientific cultivation and thereby achieve an enhancement in productivity. They also reported that the distributed inputs by the Board were of low quality forcing them to buy better products from private agencies leading to the use of unauthorised inputs. The overall trend indicates that the Rubber Board has gradually reduced the allocation of funds in this head and distribution of inputs.

Descriptive Statistics on Distribution of Quality Planting Materials

Table 4. *Distribution of Quality Planting Materials*

Sl No:	Measurement Tools	Mean	Mean Rank
1	Planting with high yielding varieties of sapling enhance productivity	4.18	1
2	There was low availability of Rubber Board certified planting materials	3.59	4
3	Better selection of sapling guarantees consistent yield and growth of the trees	4.15	2
4	Selection of better planting materials from the Rubber Board certified private nurseries ensures better quality	3.54	5
5	Subsidy motivates us to use new series clones like RRII 414, 400, 105.	3.49	6
6	Intervention of pineapple contractors in planting reduces the quality of sapling.	3.25	7
7	Better guidance from the Rubber Board help to identify better saplings	4.08	3

Source: *Computed from Primary Data*

The Rubber Board's distribution of high-quality planting materials is represented in Table 4. It shows that the rubber growers in Kerala 'Agree' with the Rubber Board's distribution of high-quality planting materials. The table shows that mean score for the first aspect of distribution and usage of quality planting by Rubber Board is 4.18 which means that 'Planting with high yielding varieties of saplings enhance productivity', mean score for the second aspect is 3.59 which means that 'there was low availability of Rubber Board certified planting materials', the mean score for the third aspect is 4.15 which means that 'better selection of saplings ensure consistent yield and growth of

the trees', the mean value for fourth aspect is 3.54 which means that the 'Selection of planting materials from the Rubber Board certified nurseries ensures better quality', the mean score for the fifth aspect is 3.49 which means that 'subsidy motivates us to use new series clones like RRII 414, 400, 105', the mean score for sixth aspect is 3.25 which means that 'Intervention of pineapple contractors in planting reduces the quality of sapling' and the mean value for the seventh aspect is 4.08 which means that 'Better guidance from the Rubber Board help to identify better saplings'. Hence it is concluded that the growers unanimously agree that replanting/new planting with high yielding sapling varieties improves production. Rubber Board training and better guidance assisted farmers in the identification of better saplings because the Rubber Board's extension operation increases the use of planting material, thus increasing the yield and quality of rubber produced. It is also seen that the involvement of pineapple contractors often leads to low quality the selection of low-quality planting materials.

Table No: 5. Descriptive Statistics on Adoption of Technology

Sl No:	Technology adoption	Mean	Mean rank
1	Usage of rain guarding ensures better technology adoption	4.16	1
2	Suggested usage of production enhancement liquids (ethephon) has led to increase in productivity	3.31	2
3	Usage of rain guarding leads to increase in incidence of diseases	2.82	4
4	Application of Ethephon induces productivity and reduce the cost of cultivation	3.25	3

Source: *Computed from Primary Data*

The mean and mean rank on the technology adoption among rubber farmers in Kerala is shown in table no:5. It is identified that the small rubber farmers in Kerala 'Agree' with the benefits of technology adoption. The table reveals that the mean score for the first aspect of technology adoption is 4.16 which means that 'Usage of rain guarding ensures better technology adoption', the mean score for the second aspect is 3.31 which means that 'Suggested usage of production enhancement liquids (ethephon) has led to increases in productivity, the mean score for the third aspect is 2.82 which means that 'Usage of rain guarding leads to increase in the incidence of disease' and the mean score for the fourth aspect is 3.25 which means that 'Application of Ethephon induces productivity and reduce the cost of cultivation. As a result, the growers unanimously agree that using rain guarding materials increases the number of tapping days, hence improving productivity, implying that growers gain from the use. Even though the Rubber Board seeks to encourage the effective dissemination and diffusion of technology in natural rubber cultivation, the growers appear to be reluctant to fall in line, as they have serious misgivings about its ultimate effects.

Independent t- Test-Effectiveness of Extension Activities

Table No:6- *Independent T-Test*

Group Statistics					
Source:	Participation in RPS	N	Mean	T	sig
Distribution of Inputs at Concessional Price	Active	237	3.3977	1.330	.162
	Inactive	147	3.4776		
Distribution of Planting materials	Active	237	3.7004	1.291	.198
	Inactive	147	3.7179		
Technology Adoption	Active	237	4.1121	2.776	.000*
	Inactive	147	3.4470		
Training	Active	237	4.2068	2.369	.001*
	Inactive	147	3.7508		

Computed from Primary Data

Table 6 shows the results of an independent t-test that was used to determine whether there was a significant difference in mean scores between active and inactive farmers' perceptions of the effectiveness of Rubber Board extension operations on productivity enhancement. The calculated p value for the attitude towards the distribution of inputs at concessional price by Rubber Board shows that there is no significant difference between active and inactive members of Rubber Producers Society (RPS) farmers. Since its p value (.162 and t= 1.330) is greater than 0.05. The calculated p value for the distribution of planting material also shows no significant difference (p value=.198 and t=1.291). The calculated p value for technology adoption (p value=.000* and t=2.776) and training of Rubber Board (p value =.001* and t = 2.369) show that there is a significant difference between the active and inactive members of RPS since its p value is less than 0.05. Hence the null hypothesis is rejected.

DISCUSSION AND CONCLUSION

The study reveals that the factors have a strong association among the parameters and all the four variables are found to contribute towards the effectiveness of the extension activities of the Board in Indian rubber cultivation. In the first set of analysis the natural rubber growers agree with the view that supply of inputs such as fertilisers and rain guarding equipment at concessional price helped in reducing the cost of production and it will encourage the farmers to adopt better scientific cultivation and thereby achieve an enhancement in productivity. They also responded that the supply of inputs by the Rubber Board were of low-quality forcing farmers to buy better quality products from private agencies leading to the use of unauthorised inputs. The second set of analysis shows that that the growers highly agree that replanting and new planting with high yielding varieties of saplings improves production.

Training and better guidance from the Rubber Board's extension services help to identify better saplings because the intervention of Rubber Board's extension activity improves usage of planting material enhancing the yield and the quality of rubber produced. Fourth set of analysis reveals the fact that the Rubber Board seeks to encourage the effective dissemination and diffusion of technology in natural rubber cultivation, the growers appear to be reluctant to fall in line, as they have serious misgivings about its ultimate effects. In last section analysed the mean scores of active and inactive farmers on the perception towards the effectiveness of extension activities of Rubber Board of India on productivity enhancement significance differences between the active and inactive members of RPS since its p value is less than 0.05. Hence the null hypothesis is rejected.

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