INSTITUTIONS AND TECHNOLOGY DIFFUSION IN AGRICULTURE: ROLE OF ISRO VILLAGE RESOURCE CENTERS

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Abstract

Economic development and growth requires institutional framework that allows economic actions to take place in an orderly and focused manner. Technology allows the rural people to get more access to knowledge and resources and that will help them to gain more economic benefits. Successful technology/knowledge transfers from lab to land improve efficiency of production, and transform the economy to a more productive one. However, the potential benefits of technology are realized only when it is successfully transferred to a large number of end-users. Space technologies are state of the art technologies of modern civilization. Indian Space Research Organization (ISRO), with the intention of disseminating knowledge to rural masses has envisaged the Village Resource Centre (VRC) concept in 2004. ISRO's VRC conduct interactive programmes on a regular basis and are connected to knowledge producing institutions and agencies. This study empirically analyzes the impact of VRCs in agriculture by capturing productivity, level of knowledge and innovation performances. Results show that the impact of new developmental intervention through Village Resource Centers are significant in knowledge diffusion, innovativeness, and productivity of farming communities, and are quantitatively measured. There is a significant reduction of information inequality and noticed the emergence of a new socio-economic relationship. VRC's helps in improving the quality of life in villages by providing new knowledge. The services are reaching the doorsteps of common man, in local language.

Keywords: Technology, diffusion, village resource centre, institution, innovation, growth, development

Introduction

Growth and development cannot take place in an institutional vacuum. Economic development and growth requires institutional framework that allows economic actions to take place in an orderly and

focused manner and in which the stakeholders are ready to take the risk of adopting new techniques for improving productivity and profit. The question of promoting equitable economic development has always been seen in conjunction with promoting access to the knowledge base at the technological frontier. But bridging the technological divide has been an uphill task. As Rodrik (2008) says: 'markets require institutions because they are not self-creating; self-regulating; self-stabilising, or self-legitimising'. Which institutions are important and which are not will differ across space and time according to the history of a country, its geography, stage of development and its political aspirations, that is, what sort of society its people want. The role played by technology in simulation of growth and development in emerging economies are quite profound. Successful technology/knowledge transfers from lab to land improve efficiency of production, and transform the economy to a more productive one. However, the potential benefits of technology are realized only when it is successfully transferred to a large number of end-users. Hence the ultimate measure of the usefulness and benefits of an existing technology can contribute to economic growth and development of an economy only when it is correctly and successfully transferred and assimilated by a large number of the intended end-users.

The capacity to evaluate new external knowledge, assimilate it, and put it into commercial ends is a must for innovative economic agents. This is known as absorptive capacity[i] and is largely a function of prior related knowledge of economic agents or system (Cohen and Levinthal, 1990). Information and Communication technology advances in space research can play a tremendous role in socio-economic development. It can be instrumental in disseminating knowledge of any kind to the rural masses and thereby act as a catalyst to development. In the 1970s, multilateral organizations such as Food and Agriculture Organization (FAO) began to implement two-way knowledge flows and information exchange between rural communities and technocrats, rather than one-way transfer of knowledge. This recognition that development comprises of more than just increased productivity led to alternative development approaches, such as the Sustainable Livelihoods (SL) approach in the 1990s. The approach is centered on people and their livelihoods. It prioritizes people's tangible and intangible assets, and their ability to withstand shocks in the vulnerability context. It also prioritizes policies and institutions that reflect poor people's priorities, rather than those of the elite (Chambers and Conway, 1991).

Technical change becomes economically important through diffusion. Technological inclusion for rural people is to enhance the absorptive capacity[ii] and thereby increasing the capacity to participate them in more economic activities. Technology allows the rural people to get more

access to knowledge and resources and that will help them to gain more economic benefits. Space technology and Information communication technologies (ICTs) are state of the art technologies of modern civilization. Appropriate institutions at local level can play an important role in the provision of technology, and information and knowledge services in rural areas. Indian Space Research Organization (ISRO), with the intention of disseminating knowledge to rural masses by using advances of information communication technology in space research, has envisaged the Village Resource Centre (VRC) concept. VRC's are one-stop service centres for farmers and communities in the areas of agricultural development, market development, and natural resources management. Located close to rural communities, these centres bring together national and local government organizations, and local people. They aim to accelerate farmer education, facilitate technology transfer and technological development, develop agricultural labour skills, and continuously enhance the learning process for all farmers, thus increasing their earnings and professional capacities.

The purpose of the study is to understand the specific role of Village Resource Centers as a knowledge provider[iii] and capability builder in order to produce innovations in agriculture at rural level.

Technology, Institutions and Economic Development.

The importance of technical change to economic growth has been noted for many years, like the endogenous growth models of Romer (1986,1990), Lucas (1988), and a host of others. Solow (1956), in his neoclassical framework noted the importance of technical change to long run growth in GDP per Capita and was assumed it as exogenous variable. Fagerberg (1994) assume that there is a cost to transmitting knowledge and believed that differences in technology are the key to differences in economic growth. He acknowledge that technology may be partially a public good, but that it is largely a specific good "embedded in organizational structures (such as) firms, networks, or institutions."

Approaches of the theories of technology diffusion can be divided into three groups: First is the most common approach is built around information and uncertainty (Mansfield, 1968). They argue that the potential adopters have little information about the new technology in the initial stage and when diffusion proceeds, others gain information from adopters and the speed of diffusion increases. The second approach is based on the heterogeneity of adopters (Stoneman, 1987) and they concentrate on "rank" approach, where the price of a new technology falls because of ranking and more will gain a positive benefit from adopting and therefore it will diffuse. The third is a strategic approach (Beath et al., 1995) where there are positive

externalities for the adoption of new technology but excessive inertia can occur, and communities may get stuck in a Pareto-inferior equilibrium.

Economic development involves learning to master new ways of doing things and a break away from the circular flow of economic activities. Mastering new ways of doing things implies transition of an economy from low value addition to high value addition activities. Development is not merely introduction and adoption of knowledge, it requires co-evolution of institutions. Lack of information can cause vulnerability. However, institutional systems can act to reduce risk and protect livelihood assets (Jock Anderson, John Dillion and Brian Hardaker 1977). In the issue at our hand, VRC is a non-market institution that assists local community by means of creation and dissemination of knowledge. We argue that in India, this institution is the major source of new external knowledge to local community, and the significant actor in the local innovation system responsible for transition of the local economy. In this entire framework the institutions intervene exactly like technological parameters in shifting the production function upwards, but unlike technological change, institutions do not alter the physical quality of resources. Village resource centers are a peculiar type of institutions clubbed with technology and can be called 'Technology institution' where, they can influence the production possibility curve as well as the physical quality of resources. VRC's are the centers of knowledge management, where they manage the raw information from different agencies and stakeholders, synthesis and add value before they deliver it to the end users.

The evolutionary point of view on economic development argues that successful development involves co-evolution of knowledge and technologies, firms and economic structures, and a variety of non-market institutions (Nelson, 2006). Therefore, the basic challenge in the process of development for a region is to learn new ways of achieving things. Improving productivity and quality requires a functioning system of technology generation and transfer and a means to implement these technologies. Extension services can provide the proper institutional system to deliver these trainings to farmers. Effective extension involves adequate and timely access by farmers to relevant advice with appropriate incentives to adopt the new technology if it suits their socio-economic and agrological circumstances (Anderson and Feder 2004). Farmers get information from many sources including public, private and corporate. Extension has greater impact on its early stages of dissemination of a new technology. As more farmers become aware of new technology, the impact of extension diminishes (Byerlee 1998). Evaluating the impacts of extension involves measuring the relations between extensions and farmers' knowledge, adoption of better practices, and use of inputs; farm productivity and

profitability; and related improvements in farmers' welfare (Anderson and Feder 2004).

It is obvious that local institutions play a big role in economic development of the local region. However it is much more difficult to identify exactly which institution matter and how it matters for the regional economic development. Therefore, it is very important to understand the specific role that has been playing by an innovative institution like Village Resource Centers in the rural areas. Information and Communication technology advances in space research can play a tremendous role in socio-economic development. It can be instrumental in disseminating knowledge of any kind to the rural masses and thereby act as a catalyst to development. In the 1970s, multilateral organizations such as Food and Agriculture Organization (FAO) began to implement two-way knowledge flows and information exchange between rural communities and technocrats, rather than one-way transfer of knowledge. This recognition that development comprises of more than just increased productivity led to alternative development approaches, such as the Sustainable Livelihoods (SL) approach in the 1990s. The approach is centered on people and their livelihoods. Development is not merely introduction and adoption of knowledge, it requires co-evolution of institutions. Lack of information can cause vulnerability.

Indian Space Research Organization (ISRO), with the intention of disseminating knowledge to rural masses by using advances of information communication technology in space research, has envisaged the Village Resource Centre (henceforth VRC) concept. ISRO's VRCs programme is in association with Non Governmental Organizations (NGOs)/Trusts and state/central government agencies, and is connected to knowledge producing institutions like Universities, government research institutes, hospitals, etc. The VRC is a totally interactive Very Small Aperture Terminal (VSAT) based network. These nodes can be further extended using other technologies like Wi-Fi, Wireless and Optical Fibre. The extensions may serve as the local clusters around the areas where the VRC is located. The overall implementation of the project will be the joint responsibility of ISRO / NGO / Partner Agency / Community. The NGO / partner agency at VRC level is expected to setup the VRC with the necessary infrastructure and ISRO will provide the equipment, hardware and software as per the required specifications. The NGO / partner agency is also expected to collect the necessary information by conducting Participatory Rural Appraisal, Rapid Rural Appraisal, Focused Group Discussions and from other sources (Recent Census) to arrive at suitable agriculture / land / water resources issues as well as health / education needs.

In agriculture, the break away or transition entails; (i) introduction of an innovative crop, that is new to the region, (ii) diversification into high value-adding crops or agricultural activities, and (iii) enhancing the existing production techniques through infusion of new knowledge or techniques. In agriculture, extension activities are necessary to transfer information from global knowledge base or from local research to farmers, enabling them to clarify their own goals and possibilities, educating them on how to make better decision, and stimulating desirable agricultural development (Van der Ban and Hawkins 1996). To warrant this transition, the capabilities for innovation have to be strengthened, and it requires co-evolution of institutions. However, institutional systems can act to reduce risk and protect livelihood assets (Anderson et al, 1977).

Structure of VRCs in Kerala

VRC in Kerala is organized by ISRO in collaboration with Kerala state Planning Board (KSPB) since 2006 to serve as a primary delivery system in rural areas. In the state it is generally known as the ISRO-KSPB Network. The ISRO-KSPB Meppadi VRC is designed to deliver services and knowledge on various subjects including health, education, agriculture, local weather, fisheries, environment, livestock keeping, livelihood support, family planning and other related trainings. VRCs also provide a variety of other services such as, information on price, market, pests & diseases, govt. schemes, e-governance related, job opportunities, and a host of other ICT based services, and act as local helpline. The VRC communication network is Very Small Aperture Terminal (VSAT) can directly interact with the experts from various sectors of development through two way audio-video interactivity. It enables each expert node to multicast the advisory, and enables each of the participating VRCs to raise questions. Expert node software enables a video return link for each VRC in such a way that all participating nodes can listen to the expert and also the questioner, along with viewing them. The classes are organized well under the professional guidance of the governmental agency. In addition to the teleconferencing programmes, additional features such as offline programmes, soil testing and dissemination of weekly weather advisories have been done for the benefits of the farmer community in Wayanad. More than 90 percent of sample population in Meppadi depends on agriculture for their livelihood, whilst more than 60 percentage of their agricultural income is from coffee in all the three groups.

Design and Methods

Both primary and secondary data are used for the study. The principal modes of data collection are field surveys, in-depth interviews (with three

interview schedules) with (i) different sections of VRC attending coffee planters, (ii) VRC non attending coffee planters from the same village, and (iii) VRC non attending coffee planters from neighbouring villages as control group. A detailed survey has been conducted at Meppadi Panchayath[48] (11°33'38.24"N, 76° 8'31.32"E) of Wayanad district in Kerala state, India, during September and October 2011. In order to collect information regarding agriculture production practices, productivity and innovation performance, we collected primary data from 170 VRC attending (VRC A) Meppadi coffee planters, 170 VRC non attending (VRC NA) Meppadi coffee planters and 170 VRC non-attending coffee planters as control group from a neighbouring villages (VRC NAN) such as, Ambalavayal (11°37'9.44"N, 76°12'37.72"E), Mooppanadu (11°32'7.45"N, 76°10'16.40"E) and Vaithiri (11°32'54.66"N, 76° 2'28.09"E). Meppadi is a high altitude interior region in the Kerala state, with large percentage of tribal population and relatively lower levels of development indicators. Coffee in Wayanad (66,999 ha.) shares 33.65 per cent of the total cropped area in the district and 78 per cent of the coffee area in the Kerala state.

Three interview schedules are used for gathering data:-

Schedule I: Mainly to collect information on agriculture productivity and knowledge - For this, a survey covering 170 VRC attending Meppadi coffee planters, 170 non-VRC attending Meppadi coffee planters and 170 non-VRC attending coffee planters from a neighbouring panchayats was conducted.

Schedule II: Gathered information on the innovative performance of Planters- surveyed 170 VRC attending Meppadi planters (rubber, coffee, arecanut, pepper, cardamom etc), 170 VRC non-attending Meppadi planters and 170 VRC non attending planters from neighbouring panchayats, Ambalavayal, Mooppanadu and Vaithiri.

Schedule III: Captured information about VRC and other development issues, covering 200 VRC attending people and 200 non-VRC attending people mostly from agriculture.

Empirical Results

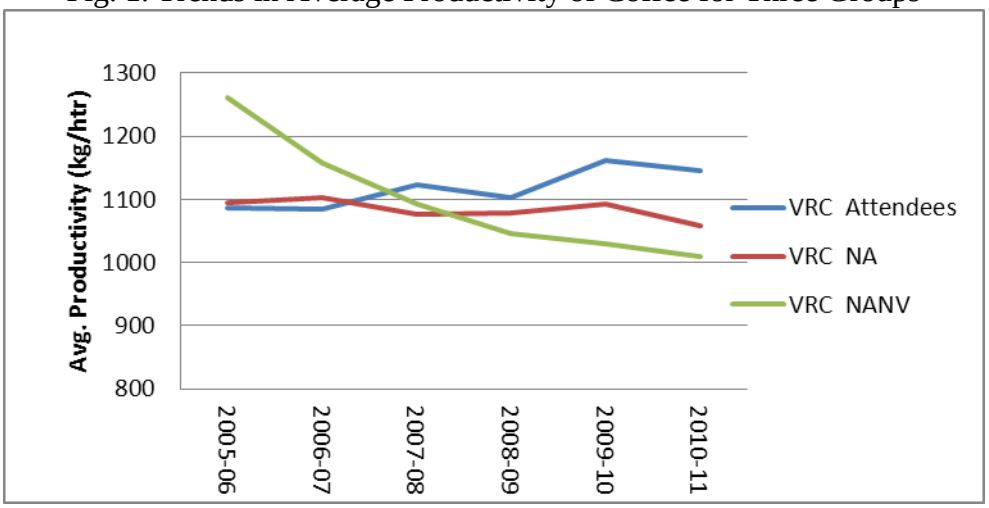
Productivity

The average productivity (kg/ha) of coffee plantation of three different sample groups is given in figure1. The average productivity of VRCA was 1086 kg/ha during 2005- 06 which fluctuated in the succeeding years and increased to 1146.1 kg/ha in 2010-11. It was 1094 kg/ha in 2005-06 in case of VRCNA and declined to 1057 kg/ha in 2010-11. During the

[48] *Gram panchayats are local self-governments at the village or small town level in India. Panchayati Raj Institutions, the grass root units of local self government have been considered as instruments of socio economic transformation in rural India. As of 2002 there were about 252,000 gram panchayats in India. The gram panchayat is the foundation of the Panchayat System (PIB, Govt. of India December 23, 2009).*

period the productivity of VRCNAN also continuously declined from 1261 kg/ha to 1008 kg/ha. It is also noticed that the productivity of VRCA is higher than that of non attendees since 2007-08. From the field, it is observed that in these periods the interventions of VRC was active in this region. It indicates the positive impact of VRC in terms of productivity. VRC ensures a greater access to information and that improve the innovative capability of the local communities for appropriate development and planning for their scarce resources.

Fig. 1. Trends in Average Productivity of Coffee for Three Groups



Source: Primary survey

The productivity of coffee in Wayanad and Kerala had also declined since 2000-01[49]. Following this macro trend, many of the survey respondents also marked decelerating trends in productivity. A deeper analysis on the patterns of productivity decline across groups exemplifies that more than 86.7 percent of VRC NAN and 70.4 percent of VRC NA reported decline in their productivity in the last 10 years[50]. On the other hand, only 33 percent of VRC A experienced decline in coffee productivity since 2000-01. Productivity decline is comparatively lower among VRC A than the other two non-attendees' groups is primarily because during the last five years VRC intervention and support was strong in the form of new knowledge inputs and subsequent changes in farming techniques[51].

[49] *Govt. of Kerala (2003), Report of the Commission on WTO concerns in Agriculture*

[50] *Figure 1.1 demonstrates that the VRC non-attendees had experienced decline in productivity during last five years. During last five years VRC attendees marked no declining trends in productivity, however during 2001-02 to 2010-11 VRC attendees also experienced decline in productivity. It is noticeable that VRC was not functioning during this period of declining productivity.*

[51] *Innovative farming techniques adopted during the period is discussed in the following section.*

From the study it is observed that there is positive correlation between area under coffee cultivation and productivity of coffee. These correlations are high among the VRC NAN (0.85), low in case of VRC NA of Meppadi (0.25) and medium in case of VRC A of Meppadi (0.68). However, it is found that VRC planters have gained productivity improvements irrespective of their size of holdings. The inter group disparity in productivity gain with respect to holding is quite marginal and hence insignificant.

Apart from size of holdings, economic theory suggests several factors which determine productivity of coffee which are mentioned in Table 1. The main purpose the pursuit is to understand how far each group has been become innovative and market oriented and relieved from their dependency on weather.

Table 1. Factors Influencing Productivity

Factors	VRC A	VRC NA	VRC NAN
No response	12.1 %	5.5 %	4.8 %
1.Weather	49.1 %	61.9 %	92.2 %
2.Improved Access to Knowledge	6.4 %	1.9 %	-
3.Market Price	16.2 %	12.5 %	2.4 %
4.Labour	5.8 %	12.5 %	-
5.Other	0.6 %	0.6 %	0.6
1 & 2	3.5 %	1.3 %	-
1 & 3	4.6 %	1.3 %	-
1 & 4	1.7 %	2.5 %	-
Total	100 %	100 %	100 %

Source: Primary survey

The table reveals that still majority of farmers are weather dependent. However, we can identify three distinguishing features of VRC attendees that make the innovative; (i) survey data indicates VRC planters are relatively less weather dependent while comparing with other two groups, (ii) VRC planters recognizes knowledge as an important factor that determine productivity, and (iii) VRC planters are more market oriented as they conceive price as a dependent variable.

Level of Knowledge

Agriculture production success is not only linked to the proper agricultural system and technological innovations, but also the right uses of agricultural information which will greatly help to boost the agricultural production. In this study we have taken the knowledge on pest management as a case for measuring the difference of knowledge between the VRC A and VRC NA. To understand the knowledge on pest management specifically in case of berry borer and mealy bugs, the study framed different set of

questions that test respondents' degree of understanding or knowledge on the corresponding facets. The field investigators were also trained on the concept of pest management and on evaluating farmers' response to each set of questions. Four degree or scales such as 'perfect knowledge', 'incomplete knowledge', 'not sure' and 'ignorant' were prepared to classify respondents according to their knowledge on certain facets of pest management. The evaluation is done by trained field investigators on the basis of their in depth interview with the respondents. Sets of questions were framed to test eight facets of knowledge, its management, and benefit. It is observed that perfect knowledge about pests that affect more frequently[52] is high among the VRC attendees (Table 2); around 75 percent of them have perfect knowledge on pests which affects their plantation. 24.5 percent of them have an incomplete knowledge about them. In case of VRC non-attendees in Meppadi, 37.5 percent have perfect knowledge but 42.5 percent have an incomplete knowledge and 4.4 percent are ignorant. Among the neighboring villagers, only 4.8 percent have the perfect knowledge and 62 percent of them having incomplete knowledge about the kinds of pests. It is also noticed that around 21 percentages are not sure about them and 12.1 percent are ignorant. From the table it can be said that VRC attendees have comparatively better knowledge regarding what kind of pests affect their plantation frequently.

Table 2. Knowledge on pests that affect more frequently

	VRC A	VRC NA	VRC NAN
Perfect Knowledge	74.9 %	37.5 %	4.8 %
Incomplete Knowledge	24.5 %	42.5 %	62 %
Not Sure	0	15.6 %	21.1 %
Ignorant	0.6 %	4.4 %	12.1 %
Total	100 %	100 %	100 %

Source: Primary survey

VRC A also have better knowledge about symptoms of diseases as illustrated in Table 3. 68.4 percent of them have perfect knowledge, 30.4 percent have incomplete knowledge and only 0.6 percent is ignorant in these matters. In case of VRC non attendees in Meppadi, 34.4 percent have perfect knowledge, 45 percent have incomplete knowledge but 5.6 percent are ignorant. Among the neighbouring villagers only 5.4 percent have perfect knowledge, 62 percent have incomplete knowledge, 18.7 percent in 'not sure' category, and 13.9 percent are ignorant in these subject.

[52] *Berry borer and mealy bugs.*

Table 3. Knowledge on Symptoms & where it affects the Plants			
	VRC A	VRC NA	VRC NAN
Perfect Knowledge	68.4 %	34.4 %	5.4 %
Incomplete Knowledge	30.4 %	45.0 %	62.0 %
Not Sure	0.6 %	5.6 %	18.7 %
Ignorant	0.6 %	0	13.9 %
Total	100 %	100 %	100 %

Source: Primary Survey

VRC A also has better knowledge about pest control methods (Table 4). 61.9 percent of them have perfect knowledge regarding this. 34.5 percent have incomplete knowledge, 3 percent are not sure about this and only 0.6 percent is ignorant. In case of VRC non attendees in Meppadi, 20.1 percent have perfect knowledge, incomplete knowledge - 46.1 percent, not sure - 23.4 percent and 10.4 percent are ignorant. Only 1.2 percent of VRC non attendees of neighbouring villages have the perfect knowledge regarding the methods for control pests. 68.3 percent have just incomplete knowledge and 17.1 percent are not sure about it.

Table 4 Knowledge on Pest Control Methods			
	VRC A	VRC NA	VRC NAN
Perfect Knowledge	61.9 %	20.1 %	1.2 %
Incomplete Knowledge	34.5 %	46.1 %	68.3 %
Not Sure	3.0 %	23.4 %	17.1 %
Ignorant	0.6 %	10.4 %	13.4 %
Total	100 %	100 %	100 %

Source: Primary survey

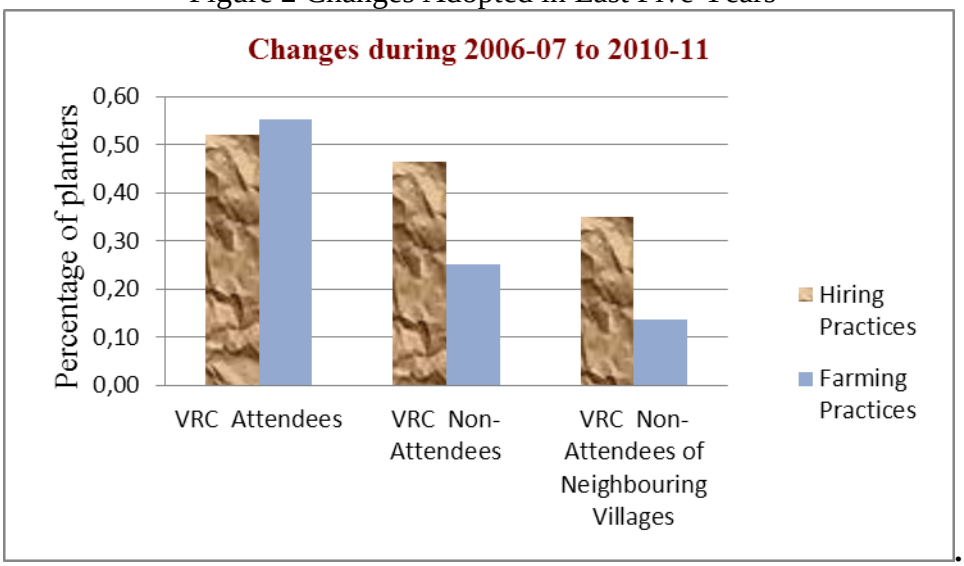
Innovation Performance

This section primarily deals with the analysis of innovations introduced in plantations over time and examination of the role of VRC in this process. The innovative changes are identified in terms of changes in farming and hiring practices; subsequently changes in farming practices are discussed in terms of changes in existing farming practices and adoption of entirely new process or varieties. Figure 2 exemplifies the innovative changes adopted by the VRC attending and non-attending planters in Meppadi and neighbouring villages during last five years. It is evident that around 55 percent of VRC A has undertaken changes in farming practices, only 25 percent of non VRC NA and 13.6 percent of non VRC NAN have undertaken changes during last five years. Major changes in the farming practices are in pruning, weeding, bio-farming, application of pesticides and insecticides, adoption of new plants/varieties[53], and crop switching[54]. In the

[53] *Mainly in coffee, pepper, cardamom, rubber, banana, nutmeg, arecanut, cocoa, suppota and anthurium.*

field, we could observe that innovative changes in farming practices as a result of new knowledge and learning is followed by subsequent changes in labour hiring practices. However, the consequent changes in labour market was quite complex, as this had significant repercussions on different incentives including incentive to innovate.

Figure 2 Changes Adopted in Last Five Years



Source: Primary survey

Changes in Existing Farming Practices

The study identify that the major changes in existing practices are in weeding, fertilizer application, irrigation, pest management, harvesting and in post harvesting techniques. Table 5 reports major changes adopted in existing farming techniques by each group during the last five years. The changes are reported under each major category for three different groups and it is evident that most of the changes are in weeding, fertilizer, and irrigation techniques. However, the intensity of changes varies extremely across three different groups of planters. VRC A planters are primarily innovative in all major categories of farming techniques[55].

[54] *Mainly towards rubber, as relative market price of rubber had tremendously increased with respect to coffee, tea, arecanut and coconut.*

[55] One example for changes in existing farming processes is in Pruning. Earlier coffee growers used to excessively graft the coffee plants but now days there has been change in grafting practices. There has been a structural change on the extent and time of pruning. The change has increased productivity by almost 1.5 times. The change has also led to reduce the number of farm labourers. This knowledge was primarily disseminated through Meppadi VRC.

Table 5. Changes in Existing Farming Practices During Last Five Years			
Farming Practices	**VRC A**	**VRC NA**	**VRC NAN**
Weeding	46.1 %	19.8 %	2.1 %
Fertiliser Application	45.1 %	20.61 %	7.4 %
Irrigation	39.9 %	16 %	1.1 %
Pest Management	30.3 %	13.7 %	0.5 %
Harvesting	21.4 %	9.2 %	1.1 %
Post Harvesting	11.2 %	4.6 %	1.1 %
Others	3.9 %	2.3 %	6.4 %

Source: Primary Survey

In case of VRC A, more than 45 per cent of planters have adopted changes in weeding and fertilizer application during last five years. The other major changes are in irrigation (40%) pest management (30.3%), harvesting (21.4%) and post harvesting techniques (11.2%). As we compare with VRC A, the performances of VRC NA and VRC NAN in case of changes in existing farming practices are low. In all facets of farming practices mentioned above, the changes from VRC NA marks only half of that of VRC A. An important question that follows the above reflection is that what have been the motivations behind those innovations? We therefore envisaged a set of factors responsible for innovation in consultation with theoretical and empirical literature on innovation. The main incentives or motivations for these kinds of changes of both VRC attendees and non attendees are depicted in table 6.

Table 6. Reasons for Introducing Changes in Farming Practices			
Major Reasons	**VRC A**	**VRC NA**	**VRC NAN**
1. New Knowledge	83 %	53 %	33 %
2. Less Remuneration	2.3 %	7 %	5.3 %
3. Pests & Diseases	5 %	20 %	22.3 %
4. Financial Difficulties	1.2 %	-	5.3 %
5. Labour Shortage	4.8 %	7 %	11.7 %
6. Others	0	0	10.6 %
7. Both New Knowledge & Less Remuneration	3.7 %	13 %	11.7 %
Total	100 %	100 %	100 %

Source: Primary Survey

It is clear from table 6 that new knowledge is the key factor for innovations in plantations. However, it is also evident that there is a significant difference reason among groups. Whilst it was the new external knowledge which induced innovations among VRC A, for the non attendees the reasons for change were largely the problems associated with existing practices that compelled them to adopt changes. In this state it is imperative to understand, what the main sources of knowledge to the rural farmers are? It will also help to understand the relative position among of VRC as a knowledge provider, among alternative sources (Table 7).

Table 7. Sources of Knowledge on Farming Practices

Sources	VRC A	VRC NA	VRC NAN
1.Traditional Knowledge	25.6 %	62.2 %	68 %
2.Krishi Bhavan	3.4 %	6.9 %	12.9 %
3.ICTs-TV, internet, News Papers etc	5.7 %	18.9 %	1.2 %
4.Suppliers of Farm Implements	0	0	6.6 %
5.Other farmers	0	8 %	11.4 %
6.Farm Organisations/Exhibition	1.6 %	4 %	0
7.VRC	8.2 %	0	0
8. Both VRC &Traditional Knowledge	55.4 %	0	0

Source: Primary survey

25.6 percent of VRC attendees, 62.2 percent of VRC NA and 68 percent of VRC NAN reported that traditional knowledge is the main source of information. In case of VRC NA, ICTs also play an important source of information. It is important to note that almost 55 percent of VRC A point out that traditional knowledge and VRC are the main sources of information. Moreover 8.2 percent of VRC attending population also revealed VRC alone is their source of information. Two important facts that can be inferred from the table 7 is that (i) VRC attending farming community depends less on traditional knowledge source compared to VRC non attending community; (ii) VRC ranks second among various local knowledge sources/institutions, and it is also noticeable that VRC attendees conceive VRC as a knowledge source more reliable than 'Krishi bhavan' and it is also ranked higher than ICTs.

Adoption of New Varieties/Plants and Processes

Table 4 reports frequencies of adoption of new varieties and/or plants, and new processes by farmers hailing from three different groups during last three years.

Table 8. Innovative methods adopted in last 3 Years

Frequency of Changes	VRC A	VRC NA	VRC NAN
New Variety / New Plants			
1	43	20	7
2	29	7	0
3	16	4	0
4	14	5	0
5	12	5	1
Total	**265**	**91**	**12**
New Process			
1	19	2	7
2	8	3	3
3	5	0	5
4	4	3	0
5	21	7	0
Total	**171**	**55**	**28**

Source: Primary survey

The first section of Table 8 reports the frequencies of varieties or plants, and the numbers of adoptions under each frequency. It can be read from the table that 43 VRC A have adopted one variety, but 20 and 7 persons in case of VRC NA and VRC NAN respectively. Among the VRC A 29 persons adopted 2 varieties, 16 persons adopted 3 varieties and number of persons adopted 4 and 5 varieties are 14 and 12 respectively[56].

There have been changes in farming process also. Whilst 57 VRC attendees out of 170 have made innovative changes in farming processes during last three years, only 15 planters amongst VRC NA and VRC NAN each have adopted changes in farming practices during the period. A concise and comparative picture of the innovation performance of VRC attendees and VRC non attendees of two regions during last three years can be

[56] *The phenomenon was not only in coffee but also in other crops such as rubber, arecanut, pepper, cardamom etc. Previously the cultivation of rubber was not at all possible in Meppadi, owing to the climate conditions, but now days some farmers started to planting rubber. Many farmers have also started adoption of new plants and varieties such as coffee, pepper, cardamom, rubber, paddy, banana, nutmeg, arecanut, cocoa, suppota, anthurium, mangosteen and rambutan.*

conceived from the aggregate figure provided in Table 4. While 265 adoptions of new varieties and/or plants and 171adoptions of new processes were identified among VRC A, VRC NA has made 91 adoptions of new varieties and/or plants and 55 new farming processes during the period. On the other hand, the third group i.e. VRC NAN have no more than 12 adoptions of new varieties and 28 adoption of new processes during the period. We can now infer that the developmental interventions through VRC for about six years have made the planters to get in acquaintance with new knowledge, learn them and innovate.

Conclusion

VRC is essentially a knowledge providing institution which aims at enhancing rural livelihood and ensuring higher income and better standard of living. The institution is a service that can harness technology to enhance livelihoods and skills for rural prosperity. This study focused on three key factors namely, productivity, level of knowledge and innovation, and specifically the role of VRC on enhancing these factors to determine economic progress and well being. This role is identified and illustrated by capturing the productivity level, knowledge level of farmers and innovation performance of VRC A and comparing and contrasting them with respect to VRC NA. This impact is primarily from the establishment of local linkages between VRCs and other local development initiatives or institutions, which enabled VRCs to establish a virtual local system of innovation. The findings of the study are also an impetus to the policy experiments with Public Private People Participation (PPPP) models. Developmental interventions through VRC for about six years have made the planters to gain more productivity, get in acquaintance with new knowledge, learn them and innovate.

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[i] Absorption capacity refers to the ability to identify and assimilate new external knowledge, and it is largely a function to prior related knowledge (Cowan and Levinthal). For instance, this reflection is true for such earlier development interventions. However in case of VRC we could observe from the field that people with relatively very less capabilities attends VRCs and benefit out of new knowledge subsequently. We would like to call it as 'subsequent wave', and it is very much evident in Thiruvayyaru.

[ii] *Ability to recognize the value of new information, assimilates it, and applies it to commercial ends. Cohen and Levinthal (1990)*

[iii] *Knowledge needs of the farmers and other stakeholders fell broadly under the areas like weather forecasts, harvest and post harvest technologies, marketing information, government schemes including subsidies, issues relating to the package of practices etc. (Kareemulla 2012).*