A Conceptual Framework to Assess the Effectiveness of different Extension Methods in Transfer of Green Technologies by NGO's, KVK's and State Department of Agriculture

Abstract

The present study was conducted in Trichy and Madurai district of Tamil Nadu. From each district two blocks were selected. The total sample size of 240 were selected for the present investigation. More than half (59.58%) of the respondents perceived that farm and home visit by NGO as the most effective method in transferring the green technology. It was clear that more than half (53.33%) of the respondents reported that farm and home visit as the most effective method in individual contact method in transfer of green technology by KVK. It was ostensible that 62.08 per cent of the farmers reported that farm and home visit as the most effective method in the category of individual contact method in transfer of green technology by State Department of Agriculture. It could be observed that F= 37.22 is significant at one per cent level of probability. It indicates that there is significant difference in effectiveness among the NGO's, KVK's and State Department. KVK's (53.54) had a highest mean value

Keywords–: Effcetiveness, Krishi Vigyan Kendra, Non- Governmeentntal Organisation, Green Technology, Training, Extension methods.

1. Introduction

Global discussions and documentation of the unfavorable effects of green revolution technology are available (Van Der Hoek et al., 1998; Wilson 2000). Despite significant primary success, the careless use of mineral fertilizers has frequently resulted in a decline in the nation's general soil health, which in turn caused a stall in the production of food grains (Abrol et al., 2000; Wang et al., 2003). There are several states where the use of fertilizer rises without any obvious matching increase in productivity. More focus is being placed on integrating organic inputs with mineral sources of nutrition in order to maintain soil health and, in turn, agricultural soil production levels. Utilizing such organic materials helps to improve the physical, chemical, and biological characteristics of soil, which improves soil quality and boosts fertilizer use efficiency (Dick and Gregorich, 2004). It also helps to increase the nutrient status of agricultural soils. To achieve the goal of sustainable agricultural growth, technological interventions for replacements have become necessary because to this knowledge and concern. The absolute motive of this study is to assess the utilization behaviour of green technologies by the farmers, understand the perceived factors behind adoption and to study the various support system methodologies and their effectiveness in the transfer of green technologies. Utilization of green technologies in cultivation practices is becoming a necessity for a better future.

2. Methodology

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The various support systems involved in transfer of green technologies in the study were Non Governmental Organisations, Krishi Vigyan Kendra and State Department of Agriculture officials. In order to analyse the effectiveness of the methodologies used by the various support systems, the various extension methods used by them to transfer green technologies were documented at first. A total of 20 different extension methods were documented based on the mode of contact as individual contact methods, group contact methods, mass contact methods, e-contact methods, training, seminar, FLD, OFT, seminar, workshop, etc. Based on the effectiveness of the extension methods in transfer of green technologies, the farmers were requested to opine their view on effectiveness level of the extension methods on a three point continuum scale as less effective, effective and most effective with the scores 1, 2 and 3 respectively. Further, the overall effectiveness of extension methods in transfer of green technologies among the paddy growers is identified based on the total scores obtained by the farmers.

Chart 1 : Based on the effectiveness of the extension methods in transfer of green technologies

S. No.	Effectiveness of the extension methods	Category	Score
1	Less effective	Less than 66	1
2	Effective	66-75	2
3	Most effective	More than 76	3

ANOVA test

ANOVA (Analysis of Variance) test was used to check if the means of two or more groups are significantly differ from each other. It helped to check the impact of one or more factors by comparing the means of different samples in the case of NGO, KVK and State Department of Agriculture.

3. Results and Discussion

3.1. Effectiveness of different extension methods in transfer of green technologies by NGO's

Among the various support systems in Trichy and Madurai district, the effectiveness of different extension methods in transfer of green technologies by Kudumbam NGO, SEVA, Green Foundation Trust and Dhan Foundation was studied and presented in Table 1.

Table .1. Effectiveness of different extension methods used in transfer of green technologies by NGO's among Trichy and Madurai district farmers

n = 240

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S. No.	Extension methods	NGO's					
		Less effective		Effective		Most effective	
		No	%	No	%	No	%
I	**Individual contact methods**						
1	Farm and home visit	28	11.67	69	28.75	143	59.58
II	**Group contact methods**						
1	Result demonstration	12	5.00	69	28.75	159	66.25
2	Method demonstration	71	29.58	57	23.75	112	46.67
3	Lecture	103	42.92	83	34.58	54	22.50
4	Discussion	29	12.08	76	31.67	135	56.25
5	Study tour	33	13.75	42	17.50	165	68.75
6	Workshop	68	28.33	140	58.33	32	13.34
7	Seminar	112	46.67	44	18.33	84	35.00
III	**Mass contact methods**						
1	Bulletin	104	43.33	88	36.67	48	20.00
2	Leaflet	29	12.08	72	30.00	139	57.91
3	Newspaper	60	25.00	96	40.00	84	35.00
4	Documentary film show	26	10.83	41	17.08	173	72.08
5	Television	89	37.08	40	16.67	111	46.25
6	Exhibitions	42	17.50	89	37.08	109	45.41
IV	**e- mode of contact methods**						
1	Whatsapp group	30	12.50	67	27.92	143	59.58
3	Websites and portals	132	55.00	68	23.33	40	16.67
5	e—mail	169	70.41	49	20.41	22	9.16
V	**Training**	29	12.08	78	32.50	133	55.42
VI	**FLD**	56	23.33	87	36.25	97	40.42
VII	**OFT**	56	23.33	75	31.25	109	45.42

From the above Table 1, it could be understood that in individual contact method, more than half (59.58%) of the respondents perceived that farm and home visit by NGO as the most effective method in transferring the green technology. Interacting and addressing the farmers at their own place builds up interest among the farmers. It makes farmers more comfortable in interacting with the officials. NGO officials have made the farmers more comfortable due to which the farmers were able to address their problems and understand the practices. The findings were in accordance with Bagdi (2014).

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In group contact methods, two-thirds (66.25%) of the respondents reported that result demonstration as the most effective method followed by discussion (56.25%) and study tour (68.75%) in transferring the green technology.

Non-governmental organization in Trichy district –played an important role in the transmission of green technologies among the farmers. It could be seen that farmers were very much convinced with what they saw as a result and believed in seeing is believing. NGO officials of both the districts have taken much effort in conducting many result and method demonstration in the farmers' field which attracted many farmers to adopt these green technologies. They conducted many demonstrations on preparation of manures like panchgavya, fish amilam and ginger-garlic mixture to avoid the incidence of pests.

More than half (57.91%) and 72.08 per cent of the farmers had mentioned leaflet and documentary film show as the most effective methods in the category of mass contact methods for transferring the green technologies correspondingly. Documentaries provide an opportunity to understand and connect with the present scenario. It's a great way to gather the farmers together and engaged them around the important topics. This could be the reason for documentary film show as most effective method in mass contact methods. In the transfer of green technologies by NGO through e- mode of contact, whatsapp groups seemed to be the most effective method (59.58%) whereas websites-portals (55.00%) and email (70.41%) mode of contact were perceived as least effective in the transfer of green technology. Though NGOs had their own websites and portals, farmers preferred direct contact than e-mode. Farmers felt that they lacked a personal touch in case of any queries.

More than half (55.42%) of the respondents reported that training as the most effective method followed by Front line demonstration (40.42%) and on-farm trial (45.42%) in transfer of green technology. Trainings helped the farmers to gain more knowledge and to acquire skills. From the observation, it was revealed that NGOs had follow-up assistance for adoption of green technologies. Moreover, trainings helped the farmers to apprehend the principle behind these technologies. This could be the reason quoted for training as the most effective method. Farmers were able to evaluate the green technology practices under realistic growing conditions which helped them to analyze and adopt the practices which could be the major reason for recognizing on-farm trial as the most effective method.

Based on the findings, it could be indicated that the NGOs of both the districts, performed well by employing various methodologies. Since NGO accumulated more external funds and were highly efficient in transfer of technology among the farmers by conducting trainings and study tours. It could be observed that there was a well-established relationship among the NGO and the farmers. Farm and home visit, result demonstrations, study tours, documentary film shows and whatsapp groups were found to be the most effective extension method for transfer of green technologies by NGO's. Better understanding, frequent contact with farmers and follow-up by NGO attracted the farmers to increase their adoption of green technologies through better transfer of green technologies.

3.2. Effectiveness of different extension methods in transfer of green technologies by KVK's

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In Madurai and Trichy district, the effectiveness of KVK's in transfer of green technologies using different extension methods was studied and presented in Table 2.

Table.2. Effectiveness of different extension methods in transfer of green technologies by KVK among Trichy and Madurai district farmers

S. No.	Extension methods	KVK's					
		Less effective		Effective		Most effective	
		No	%	No	%	No	%
I	**Individual contact methods**						
1	Farm and home visit	56	23.33	56	23.33	128	53.33
II	**Group contact methods**						
1	Result demonstration	12	5.00	69	28.75	159	66.25
2	Method demonstration	20	8.33	82	34.17	138	57.50
3	Lecture	98	40.84	69	29.75	73	30.41
4	Discussion	32	13.33	89	37.08	119	49.59
5	Study tour	46	19.17	92	38.33	102	42.50
6	Seminar	98	40.83	59	24.58	83	34.59
7	Workshop	35	14.59	73	30.41	132	55.00
III	**Mass contact methods**						
1	Bulletin	83	34.58	96	40.00	61	25.42
2	Leaflet	77	32.08	98	40.83	65	27.09
3	Newspaper	69	28.75	78	32.50	93	38.75
4	Documentary film show	36	15.00	59	24.59	145	60.41
5	Radio talk	61	25.42	89	37.08	90	37.50
6	Television	59	24.59	72	30.00	109	45.41
7	Exhibitions	22	9.16	73	30.42	145	60.42
IV	**e- mode of contact methods**						
1	Whatsapp group	34	14.16	87	36.25	119	49.59
3	Websites and portals	85	35.42	56	23.33	99	41.25
4	Applications- uzhavan	95	39.59	100	41.66	45	18.75
5	e—mail	117	48.75	92	38.33	31	12.92
6	Video conferencing	71	29.59	113	47.08	56	23.33
V	**Training**	21	8.75	54	22.50	165	68.75
VI	**FLD**	35	14.59	46	19.16	159	66.25
VII	**OFT**	58	24.17	89	37.08	93	38.75

From Table.2, it is clear that more than half (53.33%) of the respondents reported that farm and home visit as the most effective method in individual contact method in transfer of green technology by KVK. In group contact method, the result demostration (66.25%) and method demonstration (57.50%) wereas the most effective method in transfer of green technology. The results were in constrast to the findings of Baral *et.al.* (2018).

It was also seen that lecture (40.84%) and seminar (40.83%) aswere least effective methods in transfer of green technology. Though lectures and seminars helps to gain expert knowledge, networking with others and renew

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motivation and confidence, they are often considered passive as there is no mechanism to ensure that the farmers are intellectually engaged with the subject. Information tends to be forgotten quickly when the farmers were passive.

In mass contact method, less than two-thirds (60.41%) of the farmers perceived documentary film show and exhibitions (60.42%) as the most effective method in transfer of green technology. KVK served as the link between research system and farmers by accelerating development of agriculture practices in the technological aspects on the basis of introducing the achievements of progressive practice into production. This could be the justification behind exhibitions conducted by the KVK as the most effective transfer method. The results were in contrast to the findings of Singh *et. al*,(2003).

In e-mode contact methods, nearly half (49.59%) of the respondents recognized whatsapp group as the most effective method in transfer of green technology followed by websites and portals (41.25%). It is also clear that applications like Uzhavan (41.66%) and video-conferencing (38.75%) as the effective method in transferring green technology. The uzhavan app and whatspap group remain as a mean of support to the farming community. More awareness regarding the availability of these applications has to be spread in the social media. Some of the farmers also reported that the content present in this app was strong and delivered vital extension service to the farmers. The whatsapp group encourages peer learning and it promoted farmer networking and interaction. But sometimes, whatsapp groups were very soon lost when the administrator and members are unclear about the purpose of group. So, these groups and apps are yet to be utilized more efficiently to safeguard the dispersion of information to the farmers accordingly to their needs.

It could be vividly observed that more than two-thirds (68.75%) of the respondents presumed that the trainings provided by KVK officials were the most effective method in transfer of green technology followed by front line demonstration (66.25%). Trainings conducted by KVK officials were mostly related to sustainable agriculture which enhanced farmers' ability and willingness to make successful changes to their management practice. Front line demonstration provided a direct interface between the researcher and the farmers. This important mandate of KVK helped to demonstrate newly released crop production and protection technologies in the farmers field and through this, the farmers were benefitted.

Based on the findings, it could be concluded that KVKs of both the districts were found to be effective in their specific methodologies. Result demonstration, documentary film show, exhibition, trainings and FLD's were found to be the most effective extension methods for transfer of green technologies as perceived by the respondents. The possible reason for the effective transfer of green technology among the farmers using various extension methods was the increased knowledge level of extension personnel towards green technologies, environmental concern, promotion of organic farming and their knowledge level on harmful effects of chemical fertilizers made them to use more effective extension methods in transfer of green technologies.

3.3. Effectiveness of different extension methods in transfer of green technologies by State Department officials

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In Madurai and Trichy district, the effectiveness of State Department officials in transfer of green technologies using different extension methods was studied and presented in Table 3.

Table.3. Effectiveness of different extension methods in transfer of green technologies by State Department officials among Trichy and Madurai district farmers

S. No.	Extension methods	State Department officials					
		Less effective		Effective		Most effective	
		No	%	No	%	No	%
I	**Individual contact methods**						
1	Farm and home visit	35	14.58	56	23.34	149	62.08
II	**Group contact methods**						
1	Result demonstration	45	18.75	83	34.59	112	46.66
2	Method demonstration	23	9.58	77	32.08	140	58.34
3	Discussion	56	23.33	72	30.00	112	46.67
4	Study tour	39	16.26	56	23.33	145	60.41
5	Workshop	63	26.25	79	32.92	98	40.83
III	**Mass contact methods**						
1	Bulletin	123	51.25	79	32.92	38	15.83
2	Leaflet	91	37.92	93	38.75	56	23.33
3	Newspaper	34	14.17	53	22.08	153	63.75
4	Documentary film show	91	37.92	89	37.08	60	25.00
5	Radio talk	48	20.00	80	33.33	112	46.67
6	Television	79	32.92	96	40.00	65	27.08
7	Exhibitions	33	13.75	130	54.17	77	32.08
IV	**e- mode of contact methods**						
1	Whatsapp group	54	22.50	89	37.08	97	40.41
3	Websites and portals	88	36.67	56	23.33	96	40.00
4	Applications- uzhavan	43	17.91	108	45.00	89	37.08
5	e—mail	129	53.75	56	23.33	55	22.92
V	**Training**	53	22.08	63	26.25	124	51.67
VI	**FLD**	44	18.33	96	40.00	100	41.67
VII	**OFT**	37	15.41	88	36.67	115	47.92

From Table.3, it is ostensible that 62.08 per cent of the farmers reported that farm and home visit as the most effective method in the category of individual contact method in transfer of green technology. Contacting the farmers individually was found to be very effective in clarifying their doubts and guiding them personally in

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transferring the technologies. The quantum of feedback available was very high which helped the officials in reconsidering their issues. State Department officials have a good rapport with farmers, this might be the possible cause for farm and home visit as the most effective method. The findings were in line with **Bagdi (2014)**

Referring to group contact method, method demonstration (58.34%) and study tour (60.41%) were found to be the most effective method in transfer of green technology among the farmers. Group contact method is usually confined to 25-30 person which is easier to gather the farmers and demonstrated needed technologies and practices. Method demonstrations conducted by State department provided skill enhancing techniques regarding green technologies. Farmers learnt about the application of many technologies such as application of manure, fertilizers, bio pesticides which created credibility among the farmers. A tour is a series of field demonstrations on different farms, or at different centres and could often attract a lot of interest from local farmers. By attending study tours, farmers were exposed to different technologies at different places. State department officials had taken much efforts in organizing such type of group contact methods to enhance their knowledge.

Regarding mass contact method, bulletins (51.25%) and leaflets (37.92%) were recognized as the least effective method. Bulletein is a publication of around 15-20 pages, with the objective of giving complete information which the intended readers could apply to their own situation. The above printed literature had the tendency to retain the attention of the farmers with the limited capacity. Considering audio and visual aids, the printed literature were found to be less effective. Radio talk (33.33%) and Television (40.00%) were found to be effective method. Even though the evolution of ICT tools has made the farmers to easily access their needs and clarification, the conventional methods is still preferred among the farmers–. Radio talks given by the State Department officials were very crisp and clear but with limited information as reported by the farmers.. This might be the reason for lesser number of farmers reporting radio talk as effective method. Nearly two-thirds (63.75%) of the respondents reported newspaper as the most effective method in transfer of green technologies.

Less than half (40.41%) and 40.00 per cent of farmers perceived whatsapp group and websites- portals as most effective method in transfer of green technology through e-mode contact. It was also seen that 37.08 per cent of the farmers presumed uzhavan app as the most effective method of transfer. The post pandemic period, social media has created a diversion from the conventional method due to which farmers were able to access and utilize the application more efficiently through different aids. When State department officials could not visit the respective farms and villages, these application and groups had percolated the informations and clarifications to the farmers. This might the reason quoted for most effective method in transfer of green technology through e- mode contact.

More than half (51.67%) of the farmers reported training as the most effective method followed by on- farm trial (47.92%). As said earlier, trainings enables to impart skill in an individual–. Training conducted by State Department helped the farmers to enhance their skill. They conducted training on preparation of biofertilizers which boosted up many farmers and SHGs in employing themselves in their own business. The follow up of these trainings had motivated the farmers in performing in a better way.

It could be inferred that State Department officials of both the district were effective in transfer of green technologies using different extension methods. Farm and home visit, method demonstrations, study tours, newspapers and trainings were found to be the most effective extension methods for transfer of green technologies as perceived by the respondents. The possible reason for the effective transfer of green technology among the farmers using various extension methods by officials was the increased knowledge level of extension personnel towards green technologies, environmental concern and the responsibility held by them in transferring the information.

3.4. Effectiveness among the three support systems for the transfer of green technologies

To analyse the effectiveness of the support system, Analysis of Variance was computed among NGO's, KVK's and State Department of Agriculture . The results were analysed and are presented in Table 4 and Fig 1.

Table. 4. Effectiveness among NGO's, KVK's and State Department of Agriculture

S.No	Categories	Mean	Standard deviation	Standard error
1.	NGO's	44.64	12.3	0.79
2.	KVK's	53.54	12.26	0.79
3.	State Department of Agriculture	46.95	10.50	0.67
F = 37.22 **				

** - Significant at one per cent level

From the above Table 4, it could be observed that F= 37.22 is significant at one per cent level of probability. It indicates that there is significant difference in effectiveness among the NGO's, KVK's and State Department of Agriculture. KVK's (53.54) had a highest mean value followed by State Department of Agriculture (46.95) and NGO's (44.64). It shows that KVK in both the district had created more effectiveness among the farmers.

Fig.1. Distribution of respondents according to the mean value of effectiveness among NGO, KVK and State Department

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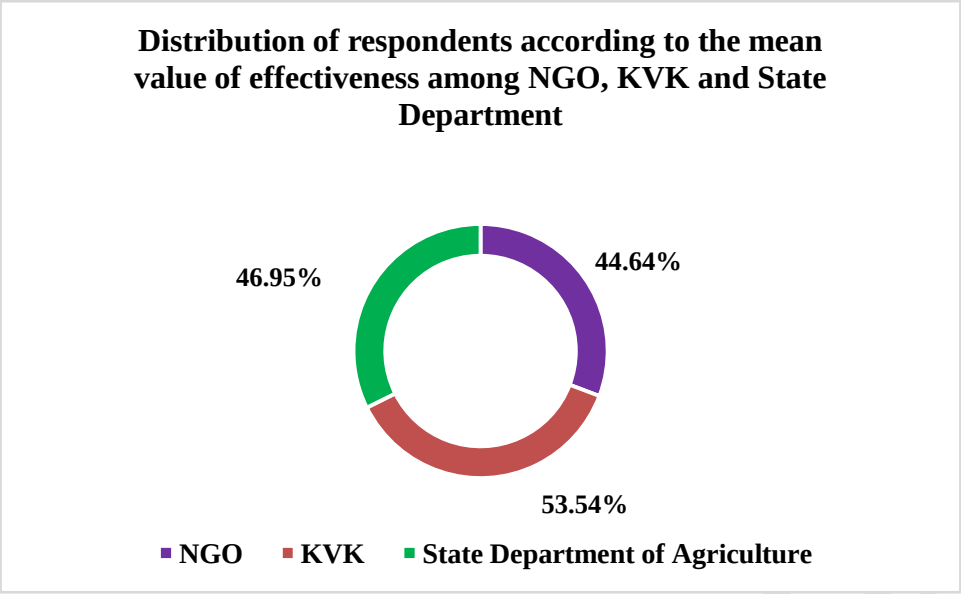

It is obstensible from the study that NGO's, KVK's and State Department of Agriculture had played an important role in transferring the green technologies through various extension methodologies. The frequent contact with the farmers by conducting various demonstrations and training had helped the farmers in apprehending the technologies in a more clear way. Moreover, KVKs and State Department of Agriculture had limited funds, so there might be some difficulties in conducting other methodologies. Whereas, NGO's acquired more of external funds so it was much easier for them to transfer the technologies with various extension methodologies.

So, to transfer the technologies more efficiently, a blend of experts in KVK's and State Department Officials and the funds from NGO's would help in percolating the practices more easily. This could support the farmers in grasping the production and management practices more accurately.

3.5. Development of model for effective transfer of green technologies

Based on the findings and suggestions put forwards by the respondents of the study, a model was developed for effective transfer of green technologies. The developed model was presented diagrammatically in Fig.2.

For effective transfer of green technologies, KVK's, NGO's and State Department of Agriculture have to work together to achieve sustainable agriculture. At present scenario, too much messages were overflowed to the society from different sources. To channelize the message, we have to develop coordination unit to finalize the message and also which extension methodologies to be used by which support system. From the study it could be concluded that FLD, video conferencing, electronic mode of extension services, result demonstration, seminar workshop are to be utilized by the KVK for transfer of green technologies. Farm and home visit, training, OFT, method demonstrations, leaflets, bulletin, trainings may be used to popularise green technologies through State Department of Agriculture. NGO's could also exercise the extension methodologies that are suggested for State

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Department of Agriculture. It is also suggested that bio input delivery unit may be established at all the block level separately for easy accessibility and availability of bio input to the farming community. Further, KVK's and State Agricultural Universities (Directorate of Agri Business) has to take step to develop entrepreneurs among youth on bio-input production and to create credit linkage to them. The products produced by the entrepreneurs are to be supplied to block level bio input delivery unit. In this connection, demand ~~arised~~arise from State Department of Agriculture, NGO's and KVK's are to be sent to the entrepreneurs in a systematic way of rotational basis to achieve sustainable agriculture which in turn will have food safety and security.

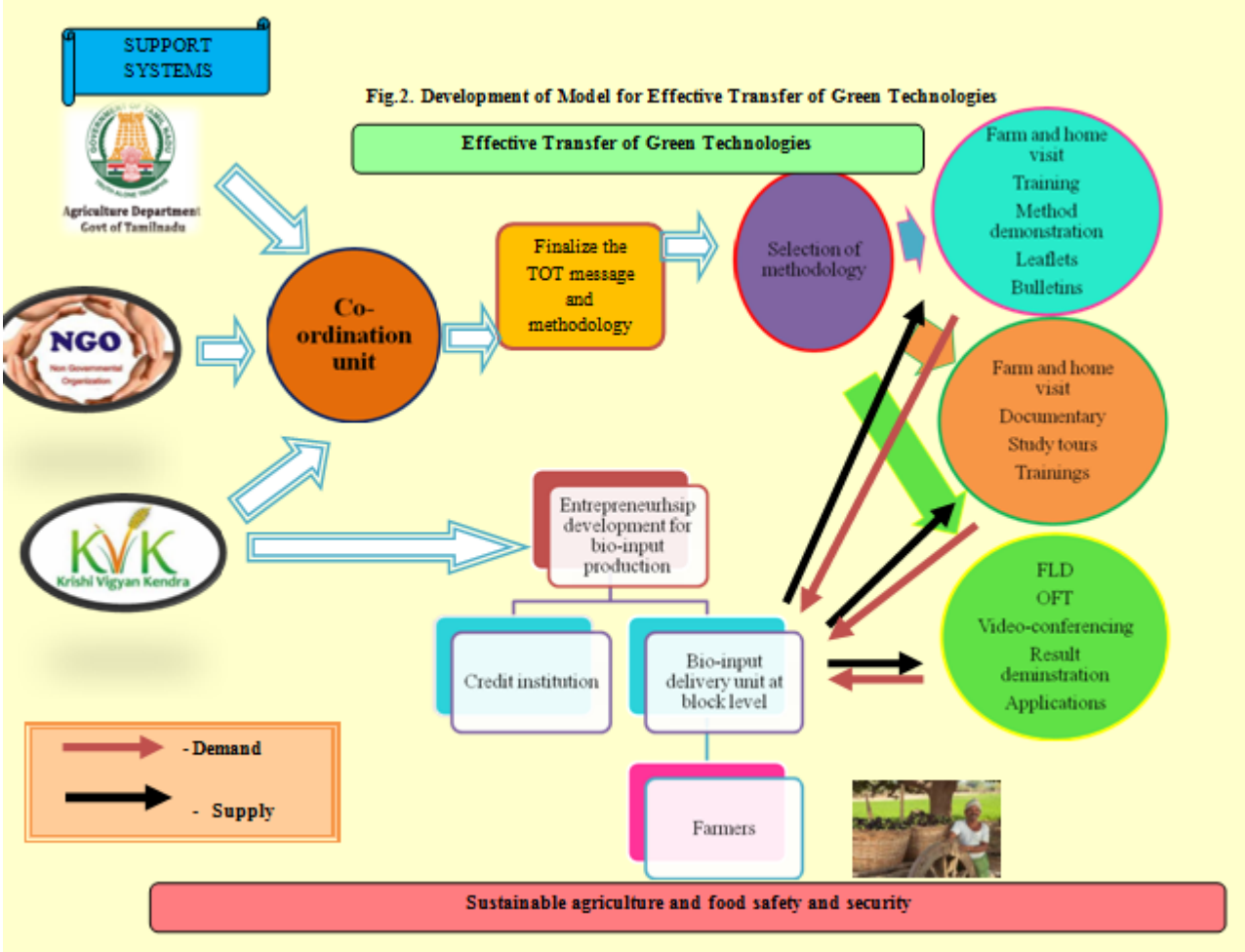

Fig.2. Development of Model for Effective Transfer of Green Technologies

4. Conclusion

The findings suggest that among the institutions, Krishi Vigyan Kendra was found to be the most effective one in technology transfer pertaining to green technologies. The effectiveness was found be comparatively low with the State Department of Agriculture and the non-governmental ~~organisations~~organizations. The KVKs could be strengthened by special financial assistance for disseminating the green technologies through various

extension methodologies. Exclusive scheme may be designed with KVK, State Department of Agriculture and NGOs as stakeholders, so as to emphasize their role in transforming to the farmers towards utilization of green technologies. This will also pave the way for incentivization under the scheme, which in turn improves the spread of utilization among the farmers. Credit support arranged by the institutions can also serve as a catalyst in persuading and encouraging the farmers to implement green technologies. Effective linkage mechanism need to be established between bio input entrepreneur and marketing wing in State Departments, KVK's and NGO's and credit institutions so as to have timely supply of inputs to farmers.

To ensure better utilization of green technologies, stakeholders associated such as extension personnel from State Department of Agriculture, KVK's and NGO's, the policy planners and all of the state machinery involved have to step up along with the ultimate stakeholder, farmers. The contribution of knowledge, experience and expertise of each stakeholder count in this case and is required to act in tandem for effectively disseminating the technologies and improve their utilization among farmers. The workable model developed for efficient transfer of green technologies would serve as a precious outcome of this study and is always subject to upgradation in future. It is safe to conclude the study with the motive of improving the utilization of green technologies among the farmers, vowing for a sustainable and healthy future.

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