‘e-Velanmai’: An ICT based agricultural extension

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Abstract

‘e-Velanmai’(Meaning of ‘Velanmai’ in Tamil is Agriculture) is a combination of personal and ICT based, demand driven and participatory technology transfer model in agriculture to provide timely agro advisory services by a multidisciplinary team of agricultural experts to the farmers using ICT tools (Tablet, internet, mobile phone etc.) through a Field Coordinator (FC) on need basis. This concept was pilot tested during 2007-2011through action research process in three sub-basins of Tamil Nadu with the support of World Bank and evolved as an effective extension model for timely dissemination of advices by scientists to the needed farmers based on the diagnosis of crop status received from FC in digital form. Farmers’ participation in the project is ensured through mobilization of membership fee ranging from Rs.50 to 150, collected based on the farm size owned by farmers. Based on the recommendations of the World Bank, the innovative extension approach, “e-Agriculture” was successfully upscaled in 14 districts (26 sub basins) of Tamil Nadu during 2011-2013.

About 10,507 farmers joined as members and availed the advisory services through e-Velanmai scheme. At least one individual from each farmer’s family was trained to handle ICT tools. About 20,211 expert advices were offered to the farmers to solve both problem and decision

based queries. All the advices were delivered to the farmers on the same day. The extension model drastically reduced the time lag in dissemination from research system to client system. The turnaround time to disseminate the technologies was 1-3 hours on the same day. The results show that the agro advisories rendered through the project had helped the farmers to improve their farm profit by achieving higher input use efficiency and adoption of appropriate dose and type of crop inputs.

'e-Velanmai" approach was evaluated and recommended by World Bank experts for implementation as a technology transfer model during 2014-15 in 100 blocks of Tamil Nadu through the extension officials (BTM/ATM) of the Department of Agriculture. e-Velanmai combines both personal approach and ICT approach. So it was made possible to offer location specific services and convince the farmers for adoption of scientific agriculture. Considering the existing extension manpower of the state department of agriculture and the ICT usage level of farmers, a combination of both personal and ICT enabled extension approach is suggested for cost effective and quality extension service.

Introduction

It is a matter of great concern that there exists wider gap between the proportion of the technologies generated by the public agricultural research system and technologies adopted by the farmers in India. Supporting this fact, the all India value of extension effectiveness index was 47 per cent indicating moderately effective extension mechanism in India (Mishra, 1996). One of the vital reasons for such wide gap is due to the lack of an appropriate extension / technology transfer model in

Agriculture that could establish better linkage between Scientists and farmers in order to facilitate effective dissemination of location specific appropriate technologies in a timely manner. Hence there is a need to develop suitable approach for technology transfer in agriculture. Considering this research issue, an attempt was done to conceive an Information and Communication Technology (ICT) based extension model called 'e-Velanmai' (means e-agriculture) for dissemination of farm specific agricultural technologies from the agricultural scientists to the needed farmers in the selected command areas of Tamil Nadu state. This model was subjected to pilot testing and validation to standardize the technology transfer process for achieving maximum effectiveness in solving the farm problems leading to enhanced returns to farmers from agriculture. The pilot experiment was done during July 2007 to March 2011 in three sub basins viz., Palar, Varaghanadhi and Aliyar of Tamil Nadu with the support of the World bank aided TN-IAMWARM project of the Government of Tamil Nadu. Based on the successful results obtained in the performance of the model, World Bank has supported for upscaling the e-Velanmai model of extension in 19 irrigation project command areas of the state during 2011-12 and in 26 sub basins during 2012-13. This paper presents about the description of the model and its performance during the upscaling phase. The specific objectives are

- To upscale the 'e-Velanmai' model of technology transfer to farmers in selected command areas of Tamil Nadu and
- To document the farmer's perception about the ICT based technology transfer model.

Concept of e-Velanmai

It is a combination of personal and ICT based, demand driven, participatory and sustainable extension approach to provide appropriate and timely agro advisory services by scientists to the registered farmers using ICT tools (Internet, Tablet, Mobile Phone etc.) on need and/or regular basis with necessary follow up actions attempted by Field Extension Coordinators (Karthikeyan, 2012).

"e-Velanmai" is described as a combination of personalized and ICT based extension approach due to the presence of human element called Field Coordinator (FC) who handles ICT tools to link farmers and experts for the purpose of technology transfer.

It is also referred as demand driven, participatory extension approach because:

- Farmers paid an annual membership fee (Rs.50-150) based on the farm size owned by them to avail the extension services under 'e-Velanmai'. The nominal fee is collected to ensure the participation of farmers in the system of technology transfer.
- Scientists attended the farmers queries based on their call (demand) or need and hence it is demand driven for technical advice or scientific farming.
- It is also believed to be sustainable approach of extension as
- It is envisioned that the farmers could operate and follow the e-Velanmai model of technology transfer by them to access technologies in the long run. The membership fee collected could be utilized to achieve sustainability of the approach. Hence sustainability component is inbuilt in the model.

Components of e-Velanmai

There are six vital components in the technology transfer model (Fig. 1). They are,

- *Farmers* who were enrolled as members in the 'e-Velanmai' scheme
- *Expert team* of Scientists (formed at TNAU)
- *Field Coordinators* (FC) to develop the capacity of farmers (Extension services)
- *ICT tools* to link farmers with the experts
- *Information* about the agricultural problems (data) collected from farmers for advice (Digital images)
- *Technical messages* (advices) delivered by the experts to solve agricultural problems faced by the farmers and *follow-up* actions on the advices adopted by the farmers.

Fig. 1.Components of e-Velanmai

1.5. Membership fees

Farmers who were interested to avail the services of 'e-Velanmai' were supposed to pay an annual membership fee of Rs.50 to Rs.150 per farmer depending on the size of their farms (Table 1). Fee structure of Rs.50-300 per farmer was decided by the farmers themselves through two

Table 1. Membership fee structure in e-Velanmai

Farm Size (acres)	Membership fees Rs./farmer/year
Up to 5	50
5-10	100
>10	150

brainstorming meetings held at village and WUA level held at Sencherimalai village and Kumarapalayam WUA respectively of Palar sub basin during September 2008. However it was revised as Rs.50-150 during the conduct of the planning workshop on upscaling of e-Velanmai. Fee collection was done mainly to enhance the sustainable participation of farmers in the scientific farming through e-Velanmai model of extension. The fee structure for availing extension services was decided as follows:

Those farmers who were interested to avail the ICT based extension advices were considered as members and enrolled in the scheme. Wherever there existed a WUA, its farmers were gathered for an awareness meeting about the e-Velanmai and those interested farmers were enrolled as members in the scheme. Each member was given a membership card containing his farm details and a record of the date of visit of the FC, problems observed and technical advices given to him by

the scientists. The membership money was deposited in the WUA account for ensuring sustainability of ‘e-Velanmai’ activities by the WUA beyond project period.

Extension activities

The extension activities organized for the benefit of the member farmers under the
e-Velanmai scheme were as follows:

- Timely technical advice on the cultivation and marketing related problems faced by the farmers directly by the expert team from TNAU using the ICT tools.
- Organize diagnostic field visit to members’ field for solving farmers’ problems
- Organize technical seminars and question - answer sessions on agricultural topics of interest to the members.
- Training the members and their children (Rural Youth) on framing digital photographs of the pest symptoms and uploading the same to the scientists for getting technical advice either through mobile or e-mail.

Accountability

The technical advices offered by the scientists were recorded in the membership card given to all the members of the e-Velanmai scheme which is used to make follow ups and bring in an element of accountability of the extension services rendered by the scientists.

Implementation of the e-Velanmai Scheme (Pilot testing)

Public model

During July 2007 the scheme was implemented in Palar sub basin by selecting five villages spread over five water users association covering 25 farmers allotting five farmers from each village. One FC was appointed to offer technical advices from the experts to the farmers. The FC visited one village per day to offer extension advice to five farmers thus covering all the 25 farmers in a week. The expert team of Scientists comprising of Entomologist, Soil Scientist, Pathologist, Crop Physiologist, Agronomist and Horticulturist was set up at TNAU, Coimbatore to offer technical advice considering the damaged specimen photographs captured using digital camera and sent to them through www.fileflyer.com website using computer and internet facilities. The advises were given by the Scientists to the FC using mobile phone which were transferred to the farmers in written form by the FC on regular basis without involving any cost to the farmer. Both soil and water sampling were done for all the 25 farms to analyze the soil and water status and the recommendations for the problems were offered considering both the digital images and these sampling results.

Similar model of e-Velanmai was adopted at Aliyar sub basin of Coimbatore district from 1st May 2008 covering 25 farms from five villages drawn from five WUA. The same model of e-Velanmai was replicated at Varaghanadhi sub basin in Villupuram district of Tamil Nadu during 1st July 2008. These two districts were distinctly different in terms of crops, water resource and agroclimatic conditions. However this model was discontinued due to poor response of the farmers to avail the ICT based extension advice offered on cost free basis in the study locale.

The experiment gave a lesson that even the quality and timely extension advice when offered to the clients at free of cost on supply driven mode will not motivate the farmers to participate in the extension process (Karthikeyan, 2011b).

For the purpose of ensuring the participation of farmers to benefit from the ICT based extension process, it was thought to alter the implementation strategy from public model to a paid model of e-Velanmai. The paid model was conceived and introduced first at Kumarapalayam WUA of the Palar sub basin from 18th October 2008.

Paid model of e-Velanmai

In order to enhance the participation of farmers in scientific farming and to have sustainability of the scheme even after the project period, paid model of e-Velanmai was conceived and the same was first introduced at Palar sub basin, followed by Chendur WUA of the Varaghanadhi sub basin from 12th January 2009 and at Mannur WUA of Aliyar sub basin from 1st February 2009. Under this model, the interested farmers of the selected WUA from the respective sub basins were enrolled as members of the e-Velanmai scheme by collecting the membership fee based on the farm size owned by them. A membership card was given to the farmer and a record of the agricultural problems and advices given by the scientists were noted in the card. These members availed the benefits of e-Velanmai extension activities as mentioned under the public model. In each of the member's family, at least one person was thoroughly trained in handling the ICT tools for the purpose of framing the crop status images and to access the advices from experts. It was envisioned that the trained individual is expected to

capture and send the digital images of the pest damaged symptoms and receive the technical advice from the experts of TNAU. The paid model of e-Velanmai has been upscaled in the following 19 subbasins (Phase I and II) during 2011-2012 (Table 2) and 26 sub basins (Phase I to IV) during 2012-2013 (Table 3). In each sub basin, one scientist took the charge of implementing the scheme. One FC was appointed to link the farmers and scientists for the purpose of technology transfer. An expert team comprising of crop protection and crop management was identified in either a KVK/Research station located in each of the sub basins to offer scientific advices to farmers.

Table 2. Upscaling of e-Velanmai (2011-2012)

Sub Basins	
I – PHASE	Nallavur
Varaghanadhi	Ongur
Upper Vellar	Thurinjalar
South Vellar	Gadilam
Kottakaraiyar	Gridhamal
Manimuthar	Uthirakosamangaiyar
PAP - Palar	Deviyar
II – PHASE	Hanumanadhi
Ponnaiyar	Kambainallur
Agniyar	**IV – PHASE**
Swethanadhi	Cooum
Koundinyanadhi	Adayar

III – PHASE	Cheyyar Killyar
Araniyar	Paralaiaru
Kosasthalaiyar	Amaravathi

Table 3. Upscaling of e-Velanmai (2012-2013)

Sub basins	
I Phase	**II Phase**
Varaghanadhi	Ponnaiyar
Upper Vellar	Agniyar
South Vellar	Ambuliyar
Pambar	Swethanadhi
Kottakaraiyar	Nichabanadhi
Manimuthar	Kalingalar
Arjunanadhi	Therkar
Aliyar	Upper Gundar
Palar	Koundanyanadhi
	Poiney

Operational schedule for technology transfer

The operational procedure in the technology transfer process (Fig.2) was initiated by any farmer who is in need of technical advice in the sub basin. The farmer calls the FC over his mobile and the FC goes to the farmer's field and examines his crop status. In case the farmer is in need of decision based advices such as suitable variety, marketing

decisions, spacing etc., then the advices were given on the spot by the FC by referring to the TNAU agri portal. In the case of a problem based query raised by the farmer say for example the management of an insect pest, disease, nutritional deficiency, weeds etc., the advices will be given to the farmer based on a digital photo document captured by the FC and sent to the experts using internet. The images were coded using the farmer's name and identity number. The experts diagnosed the problem photos and offered solutions to the respective cases. These recommendations were downloaded and recorded in the membership card given to the farmers respectively.

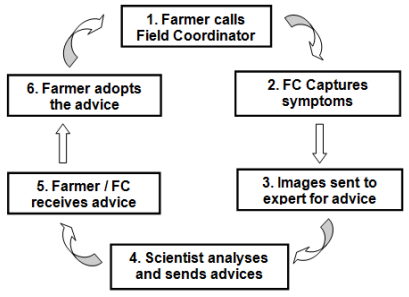
Results and Discussion

The results on the experimentation (Pilot test + upscaling) of the scheme and the lessons learnt are presented as follows:

Membership status in e-Velanmai

Farmers were enrolled in the scheme as members by collecting a membership fee of Rs.50 to 150 per farmer based on their farm size. About 10507 farmers had joined the scheme (Table 4) by paying the prescribed

Fig.2. Stages in Technology Transfer Process



annual membership fees. The gender wise distributions among the members revealed that 89.76 per cent were male and the rest were female. The farm size wise distribution of the members indicated that a majority of small and marginal farmers (80.60 %) who operated < 5 ac land holding had participated largely as compared to medium and big farmers. The fact that more than three-fourth proportions of farmers in the state were small farmers could be attributed for the result obtained. The results suggest that farmers irrespective of their land holding had expressed their willingness to pay behavior towards availing quality and timely extension advices (using ICT tools) to adopt scientific practices in their farms

Table 4. Membership enrollment in e-Velanmai

Sub Basin	No. of farmers enrolled									Total No. of members enrolled		
	<5 ac			5-10 ac			>10 ac					
	Male	Female	TOTAL	Male	Female	TOTAL	Male	Female	TOTAL	Male	Female	TOTAL
TOTAL	7490	979	8469	1814	93	1907	126	4	130	9431	1076	10507
%	71.29	9.32	80.60	17.26	0.89	18.15	1.20	0.04	1.24	89.76	10.24	100

Farmers' contribution to avail extension services

Depending on the farm size owned by the farmers, they paid the membership fee of Rs.50 to Rs.150 per farmer. The members were offered extension advices and training on handling ICT tools. A total amount of Rs.6,54,700 was mobilized from the farmers to offer quality and timely scientific advices in agriculture from the experts of TNAU. An amount of Rs.5,94,050 was contributed by male farmers and the share of farm women was Rs.60,650 (Table 5).

Table 5. Membership fees collected

Sub Basin	No. of farmers enrolled									Total No. of members enrolled		
	<5 ac			5-10 ac			>10 ac					
	Male	Female	TOTAL	Male	Female	TOTAL	Male	Female	TOTAL	Male	Female	TOTAL
TOTAL	374900	49300	424200	189500	10300	199800	29650	1050	30700	594050	60650	654700
%	57.26	7.53	64.79	28.94	1.57	30.52	4.53	0.16	4.69	90.74	9.26	100

This amount was deposited in rural banks by creating a separate account in the name of the social organization/WUA maintained as joint account to be operated by the leader of the social organization and the scientist-in-charge of the sub basin. The money is proposed to be used to avail extension advices/agril. information from the experts/media sustainably after the closure of the scheme in the sub basin.

Awareness meetings and Seminars

Trainings include the awareness meetings and technical seminars organized for the benefit of the farming community at village / WUA level in each of the selected sub basins. The farmers were also trained to handle the ICT tools such as framing the crop status images, uploading the images to the scientist and accessing the scientific advices using computer and internet to solve farming problems. The table 6 results reveal that 9789 trainings were organized in all the selected sub basins covering all the members of e-Velanmai. These trainings were benefitted by 13919 farmers.

Table 6. Total number of trainings conducted

Overall Total	Number of WUA / Social Groups	Total number of trainings / meetings	No. trained
	430	9789	13919

Capacity building on handling ICT tools

The farmers were trained to handle digital camera to capture crop status images that can express the pest attacked symptoms clearly. Trainings were also organised to the farmers for the purpose of accessing scientific advices through internet. All the 10507 members of e-Velanmai were trained in handling either or both the ICT tools. Among this trained category of farmers, a majority of them were trained in handling a camera (74.82%) and about 25.18 per cent were trained in internet media. The category of trained farmers revealed that more than half of the trained group were farmers' wards (80.24%) followed by young farmers (19.76%) Experiences reveal that the children or the youth belonging to the farmers' family had expressed relatively hi*g*her level of interest and favourable attitude to learn how to handle ICT tools as compared to the farmers/farm women. It was intended to train at least one member in each of the farmer's family so that they can help their family members in accessing the advices from the experts in future.

Agricultural Extension Advisory Services

Experiences on answering the queries raised by the farmers revealed that there existed two types namely (i) Problem based queries and (ii) Decision based queries. Problem based queries were answered with the help of the crop status images (Eg. Pest damaged symptoms) whereas the decision based queries (Eg. Marketing decisions) were answered on the

spot using the TNAU agriportal website and other technical data base in agriculture. These queries were also analysed according to the subject matter it represented. The results reveal that about 20,259 queries were tackled by offering suitable technical advices to the farmers. Among these queries, a majority come under the plant protection subject (54.22 %) followed by crop management (34.36 %) and other subjects (11.42 %) such as Marketing, Post harvest technologies, Agricultural Engineering etc. It is a well known fact that the presence of an insect pest or disease or lack of micro and macro essential nutrients in the crop will express damage symptoms and hence these problems were visible and makes the farmer to get concerned about the problem. This might have influenced the farmers to raise more problem based queries (73.97%) focussed on crop protection aspects followed by management decision based queries (26.03%). *It is proved that an agricultural expert can offer effective technical advices to farmers based on the digital images of the crop status, even without visiting the farmers field in person* (Table 7).

Table 7. Technologies transferred to farmers

Year	Subject-wise No. of advices given								Total No. of advices given		Grand Total
	Pathology	Entomology	Physiology	Soil science	Agronomy		Marketing	Others			
	PB	PB	PB	DB	PB	DB	DB	DB	PB	DB	
Advices	5643	5343	1577	496	764	4117	1301	1028	14985	5274	20259
%	27.85	26.37	7.78	2.49	3.77	20.32	6.42	5.07	73.97	26.03	100

Adoption status of the advices offered to farmers

The farmers' queries were answered by the experts in the case of problem based queries and the decision based queries were answered on the spot by the FC or after getting the advice from the experts. These advices were adopted at farm level by an overwhelming majority of the farmers. The ratio between the number of farmers queried to adopted was found to be 84.61 per cent (Table 8). The success rate of the adopted farmers was found to be 91.10 per cent and the remaining seems to be landed in failure due to various reasons such as shortage of labourers for adoption of recommended practices, lack of conviction of farmers over the recommended practices and high cost of recommended inputs.

Table 8. Adoption status

26 Sub basins	**Number of queries**	**Number of advices adopted**	***Success rate (%)**
Total	20259	17142	91.10

Rate of adoption 84.61%

*(Success rate due to the adoption of advices among the adopted farmers)

Reasons for non adoption of the recommended advices

The problems confronted by the farmers were identified either by the Scientist or the FC and the appropriate advices were recommended to the farmers in time within 3 hours. However some farmers did not adopt the advices in their farm due to various reasons. Hence a survey was collected with 500 randomly selected samples from all the selected sub basins and the results are given in the Table 9.

The findings on the reasons for non adoption of the recommended advices revealed that a majority of the farmers (23.60%) felt that they were not able to procure the recommended agro inputs from the local input shops. Shortage of labour to perform various agricultural operations in the village was also identified as one of the reason for non adoption (20.60). The other reasons for non adoption of the advices include, high cost of the recommended inputs (13.60%) such as Methomyl, Nativo etc., which was sold for Rs.1000 to 6000 per kg. Lack of conviction of farmers for want of observable results in the field immediately after adoption of the practices (17%), resistance to change attitude of farmers (7%) for adoption of new technologies.

Table 9. Reasons for non adoption of the recommended advices

Sl. No.	Reasons for non adoption of advices	No. of farmers* (N=500)	Percentage
1	Non-availability of prescribed pesticides in local area	118	23.60
2	Shortage of labourers for adoption	103	20.60
3	Lack of conviction of farmers for want of immediate observation of results	85	17.00
4	High cost of recommended inputs	68	13.60
5	Resistance to change attitude of farmers	35	7.00

***** Multiple responses recorded

Reasons for failure after adoption of the advices

The technologies advised to the farmers were not adopted scientifically as per the correct dose and specifications recommended. Hence 9 per cent of the farmers reported failure in their farms (Table 10). Agricultural operations have to be done in time to achieve a successful crop. However depending upon the availability of the labour in the village as well as the sprayer availability on hire basis from the owner farmers, the spraying of pesticides was undertaken by the farmers which had not favoured the farmers for a successful crop. Hence this had resulted in failure as reported by 7.6 per cent of the farmers. Some farmers (4.4 %) opined that the input shop keepers interfered in altering the suggestions of the experts and attempted to recommend higher dosage of inputs/alternate inputs thus preventing the farmers to adopt as per the advices of the experts which had not yielded good results in the farm. Few farmers (3.6%) received the recommendation in time but attempted to adopt latter thus missing the appropriate growth stage of the crop leading to failure. Other group of farmers had reported that they had ignored the recommended seed treatment technology in paddy due to sudden onset of monsoon in their village thus landing in the failure of the crop.

Table 10. Reasons for failure after adoption

Sl. No.	Reasons for failure after adoption of advices	No. of farmers (N=500)	Percentage
1	Improper adoption against recommendation	45	9.00

2	Spraying based on the labour/sprayer availability	38	7.60
3	Interference of the private dealer in adoption of the recommendation	22	4.40
4	Adopting the recommendation at inappropriate stage of the crop.	18	3.60
5	Urgency in sowing operation ignoring the seed treatment technology	18	3.60

Benefits / advantages realized by farmers due to e-Velanmai model of extension

The farmers were enquired about the benefits they realized due to the adoption of technical advices received through the e-Velanmai method of extension. The results are presented in the Table 11.

Table 11. Benefits / advantages realized by farmers

Sl. No.	Benefits realized	No. of * farmers (N=500)	Percentage
1	Timely advices were received at individual's farm level/door step	455	91
2	Saved input cost to manage/protect a crop	375	75
3	Reduced crop loss/obtained higher yield and earned more income.	365	73

4	Precise and appropriate recommendations adopted to tackle problems	310	62
5	Dependence over input dealers for advices decreased	240	48
6	Adopted improved/scientific methods to manage the pest and diseases	180	36
7	Gained awareness/knowledge about the management of various pests/ symptoms/ and fertilizer dosage.	165	33
8	Use of biofertilizers, biocontrol methods for different crops were learnt through FC	125	25
9	Awareness/acquired skill to operate ICT tools like camera and internet for further contact with experts	125	25
10	Functioning of social group through e-velanmai scheme	75	15

***** Multiple responses recorded

It was observed that an overwhelming proportion of farmers felt that they were able to receive the advices timely on the same day when they raised the query to the field coordinator of the project. They were also happy to enjoy the benefit of access to the recommendations either at

their door steps/farm level itself. Nearly three-fourth of the beneficiaries opined that they were able to achieve input use efficiency i.e., saved money on investment over inputs use to manage the crop production or protect the crop from various pest and diseases. Almost an equal proportion of farmers reduced their crop loss due to the adoption of the recommended management practices resulting in achievement of higher yield and income. More than half of the beneficiaries reported that they were able to adopt the precise and appropriate recommendations to tackle various problems confronted in their farm.

Prior to the introduction of e-Velanmai project in the village, nearly half of the farmers stated that they depended on the input shop keepers/dealers available in their locale for crop protection advices. This situation had changed for them after the introduction of e-Velanmai as they were able to access all advices related to agriculture at their farm gate itself. About one-third of the farmers reported that they were able to adopt improved management/crop protection practices. In other words, one-third of the farmers stated that they had come to know about various pests, their symptoms and management technologies in agriculture.

About one-fourth of the beneficiaries expressed that they had learnt about the use of bio-fertilizers and bio-control methods in crop protection from the field coordinators as such technologies were recommended to the farmers. Farmers also reported that they had acquired skill to operate the ICT tools such as digital camera to capture crop status images or internet to access the recommendations from the experts of the project. Few farmers had opined that they gained social recognition and support to share agricultural information among a group of farmers due to the functioning of social groups formed under the e-Velanmai project at their

village level.It could be inferred that farmers had endorsed several economic, personal and social benefits/advantages due to their participation in the e-Velanmai project to access and adopt scientific advices to tackle their farm related problems.

Problems perceived by farmers to access / adopt advices from e-Velanmai

The farmers were asked about those problems faced / expected in future by them to follow the e-Velanmai mode of accessing the recommendations/adopting the advices from the experts. The responses were gathered and presented in the following Table 12.

Table 12. Problems perceived by farmers to access / adopt advices from e-Velanmai

Sl. No.	Problems	No. of farmers (N=500)	Percentage
1	Faced problems in the use of ICT tools for access to advice by themselves	165	33
2	Non-availability of ICT tools	150	30
3	Poor internet connectivity in rural areas	110	22
4	Unexpected rainfall wash away the sprayed pesticides	100	20
5	Pesticide and fungicide names labeled in English	60	12

Although the farmers in e-Velanmai project received appropriate advices from experts few farmers had expressed some problems as discussed here. About one-third of the farmers lack confidence and faced the problem of handling ICT tools namely digital camera, internet and computer to access the advices from the experts by themselves without the help of the field coordinator. About 30 per cent of the farmers although they had knowledge to operate the ICT tools, they expressed that it was not possible for them to adopt e-Velanmai model to access advices by themselves due to the non availability of ICT tools with them.

Poor internet connectivity existing in the villages was expressed as one of the problems to access advices by about 22 per cent of the farmers who were either confident or supported by their trained family members to access the recommendations from the experts in future.

One-fifth of the beneficiaries reported that even though they were successful in adopting the recommendations given by the experts, they landed up in failure due to the unexpected rainfall that occurred after the spray of the recommended pesticides in the field. About one-tenth of the farmers expressed their inability to understand whether the same pesticides as prescribed by the experts were issued by the input shops. This is due to the illiteracy condition of the farmers which limited them to read the name of the input that is labeled in English version.

Any innovation will certainly have its own problems to perform successfully at field level and e-Velanmai model of technology transfer is not an exception. However the model performed effectively at field level and the problems listed by the farmers are not the lacunae existing in the method of extension. Improvement of economic conditions and change of the mindset or attitude of farmers to learn and use to handle ICT tools

could overcome the problems in near future. **Sustainability of 'e-Velanmai'** The sustainability of offering the extension advisory services through 'e-Velanmai' approach even after withdrawal of support from TN-IAMWARM project was studied. Three models to sustain e-Velanmai was experimented and the results are presented as follows.

Model – I: Involving Rural Youth as FC

The option of engaging the interested rural youth to assume the role of Field Coordinator for the purpose of technology transfer was field tested at Palar sub basin. Mr.Sakthivel from Senjerimalai village had shown interest to perform the role of field coordinator. He was promised to be paid Rs.10 for every case he dealt with for providing advisory services. He got trained to handle ICT tools for technology transfer purpose. The ICT tools were provided to him from the project. From the researcher's assessment, he was not capable enough to offer appropriate advices to the farmers, as he lacked the technical knowledge which is essential to perform appropriate advisory services to farmers. From his personal view, he felt that on an average maximum of five cases per day were attended by the youth. Hence he demanded an amount of Rs. 300 per day as salary from the project. Four such volunteers from different villages of Palar sub basin were approached and all of them were of the same attitude of earning a fixed and assured income from the project. Considering the attitude of the rural youth, it was not judged as a sustainable option and hence the idea of involving the rural youth did not work out fruitfully to sustain the project.

Model – II: Public – Private Partnership

The Tata Consultancy Services (TCS), Chennai was approached to collaborate with the project and offer the advisory services for the farming community of Villupuram district and latter to other areas in Tamil Nadu. TCS gave a proposal regarding the modalities and means by which they can venture into the project. As per the proposal, TCS has described that they could collaborate with TNAU under certain conditions. The subscribing farmer will have to pay annual fees to avail theextensionservices. In the 1st, 2nd and 3rd and 4th year the fees would be Rs.1000, Rs.1200, Rs.1300 and Rs.1400 respectively. In the first year the fees would be 100 % subsidized. Farmer will have to bear the cost of GPRS charges. In the first year TN-IAMWARM project would bear the GPRS cost. The cost could differ from one telecom operator to other. BSNL provides free data download on certain recharge packages but the quality is poor. The average per farmer per year cost would be around Rs.1200. The willingness of farmers towards the TCS proposal was enquired with the farmers of Varahanadhi, Thurinjalar, Ongur and Nallavur sub basins. None of the farmers in all the four sub basins were willing to accept the idea as it involved huge cost sharing from the farming community to access ICT enabled extension services. The researchers also felt that the proposal given by TCS is a typical business oriented model rather than service oriented one and hence there is no point in proceeding further with TCS to sustain the project. In case if TCS had considered offering the extension services to farmers under the banner of Corporate Social Responsibility initiatives, then the project would be feasible and sustainable in the long run. Hence the PPP venture between TNAU and TCS was proved to be a futile attempt.

The Indian Tobacco Company Ltd. is already providing ICT enabled agricultural extension services to the farmers in selected areas of Sivaganga district. They have already established ICT infrastructure in selected villages and employed field staff to offer extension advisory services to farmers. They were willing to collaborate with TNAU for obtaining the technical advices from scientists and transfer the same to the farmers. However the scope of operation is limited to the selected areas of the district only. They were not willing to extend their area of operation to cover TN-IAMWARM Sub basins of the district. Hence the project could not be extended sustainably either in sub basins of TN-IAMWARM or other parts of Tamil Nadu.

Model – III: Public – Public Partnership

It was felt that the state department of agriculture which is holding the major responsibility to transfer agricultural technologies to farmers in the state could be an option to sustain the project. Accordingly, the Joint Director of Agriculture, Coimbatore district and the Deputy Director of Agriculture (DPAP), Coimbatore was approached to instruct the Block Technology Manager (BTM) working under ATMA of one block coming under Palar sub basin namely the Sultanpet block to enact the role of Field Coordinator (FC) and offer ICT enabled extension advices to the farmers. The officials accepted and gave oral instructions to the BTM for offering the extension advices to farmers using the already available data base regarding the crop status and recommendations offered to the Palar sub basin farmers. An awareness meeting to the farmers about the involvement of the BTM as FC was held on 26th July 2011 at Senjerimalai village. The meeting was conducted by

the top Officials of the Agriculture department and TNAU. It was attended by the members and office bearers of four WUA. Farmers accepted the idea to obtain the e-Velanmai mode of technology transfer through BTM instead of FC engaged in the project. Farmers were willing to pay and access the ICT enabled extension services. All the BTMs of Coimbatore district were trained on 21st June 2012 at TNAU, Coimbatore to implement e-Velanmai. It was found that the BTM of Sultanpet block is capable to transfer appropriate technologies to farmers using the existing data base on crop status images and advices developed under the project (Karthikeyan, 2012). It was also understood that BTM/SMS could be involved effectively to offer ICT enabled agricultural extension services to farmers and the project could be operated sustainably in Tamil Nadu. However it is felt that suitable orders from the Government of Tamil Nadu is needed to fix the role of providing ICT enabled services by the BTM/ATM of ATMA as one of the extension responsibility in addition to other existing responsibilities being attended by the BTM/ATM.

Considering the socio-economic scenario of farmers in Tamil Nadu, *it is recommended that Public – Public partnership could be a viable and feasible option to sustain e-Velanmai project in Tamil Nadu.* During May 2014, the relevant Government Order, G.O. 4(D). No. 11of the Agriculture Production Commissioner and Secretary, Dt.15.05.2014 Agriculture (WD2) Department was released from the Government of Tamil Nadu for implementing the e-Velanmai model of Agricultural Extension in 100 Blocks of Tamil Nadu state during 2014-15.

Name of the farmer / Village	:	Mr.Ravichandran Ponnankuppam village
Crop	:	Sugarcane
Crop area	:	5.0 acres
Problem identified	:	Internode borer incidence
Advice given	:	Release of parasite *Trichogramma japonicum* 2cc/acre
Benefit perceived	:	Gained 10-15 per cent additional yield (Rs.8800/ac)

Name of the farmer / Village	:	Mr.T.Thangarasu Manthiripalayam village
Crop	:	Coconut
Crop area	:	3 acres
Problem identified	:	Bud Rot (Fig 1)
Advice given	:	Blue copper 3g in 1 litre of water
Benefit perceived	:	Saved amount Rs.5250/- (Opportunity cost)

Name of the farmer / Village	:	Mr. S.Murugesan Parappancholai village
Crop	:	Turmeric
Crop area	:	2 acres
Problem identified	:	Leaf spot (Fig 2)
Advice given	:	Spray of Carbendazim 2gm/lit of water
Benefit perceived	:	Additional income of Rs.10000/acre

Name of the farmer / Village	:	Mr.M.Dinesh Neikuppi village
Crop	:	Snake gourd
Crop area	:	10 acres
Problem identified	:	Powdery mildew (Fig 3)
Advice given	:	Spray Mancozeb 2gm/lit
Benefit perceived	:	Saved the crop from 10-15 per cent yield loss (Worth Rs.6480/ac.)

Name of the farmer / Village	:	Mr.R.Krishnadoss Indhalur village
Crop	:	Paddy
Crop area	:	3.0 acres
Problem identified	:	Leaf Folder incidence (Fig 4)
Advice given	:	Spray of Hostathion @ 250ml /acre
Benefit perceived	:	Gained 20 % additional yield worth Rs.6000/ac

Name of the farmer / Village	:	Mrs.Suguna Perumberkandigai village
Crop	:	Brinjal
Crop area	:	2.0 acres
Problem identified	:	Fruit Borer (Fig 5)
Advice given	:	Spray Chloripyriphos 2ml/lit
Benefit perceived	:	Gained additional yield of 850 kg/ac worth Rs.4250/ac.

Lessons Learnt

The lessons learnt from the action research project is listed as follows:

1. Appropriate farm specific and timely agricultural extension advices can be offered by the agricultural experts to solve the farmer's problems based on the crop status images sent to by field extension staff or farmers from the field using ICT tools.
2. Farmers will come forward to pay a nominal fee based on their farm size for accessing quality and timely extension advices from agricultural experts.
3. Farmers across gender and farm size had shown interest and participated in the ICT enabled extension process to access scientific advices from experts.
4. The upscaling of e-Velanmai project is feasible, workable and replicable in the irrigation project command areas of Tamil Nadu.
5. It is possible to train at least one member of the farmers' family to handle ICT tools to access scientific recommendations from the experts.
6. It is possible to sustain the ICT enabled personalized extension approach by involving the existing manpower (BTM / ATM) of ATMA as FC for technology transfer to farmers effectively and efficiently.
7. Combination of personal + ICT approach of extension is found to be effective and timely to address the issues of farmers in agriculture.

Suggestions

1. e-Velanmai combines both personal approach and ICT approach. So it was made possible to offer location specific services and convince the farmers for adoption of scientific agriculture. Considering the existing extension manpower of the state department of agriculture and the ICT usage level of farmers, a combination of both personal and ICT enabled extension approach is suggested.

2. In order to sustain the project activities in the long run, Public-Private-Partnership arrangements with the IT based companies, NGOs and Agro input manufacturing industries who are interested to extend ICT enabled farming advisory services as a part under Corporate Social Responsibility initiatives need to be explored. Alternatively, the Department of Agriculture of the Government of Tamil Nadu can adopt the e-Velanmai model as one of the effective means to provide technical advises to farmers and enhance farm productivity at state level.

3. It is suggested to provide tablets and train all the Assistant Agricultural Officers, Block Technology Manager (BTM) and Assistant Technology Managers (ATM) of ATMA scheme working in the Department of the Agriculture and allied departments so that they can deliver the role of ICT based technology transfer service effectively.

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