Designing of the participatory and bottom up approach based decision support system (PBDSS) for horticulture crops in Meghalaya.

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ABSTRACT

Decision Support System since it was designed first time in 70s took various forms from simple DSS to PDSS (Participatory Decision Support System) to IDSS (Integrated Decision Support System). (Power D. J. (2003). Some of these types could not take off because of lack of farmers participation in its designing this excluded problems faced by farmers in cultivation of different crops.(Attanandana *et.al.*,),This failure of different DSS to solve the farmer's problem led involment of the farmers in the designing of the DSS and this took the form of the PBDSS (Participatory Bottom up approach based Decision Support System).While designing PBDSS participation of the farmers ensured by providing interview schedule to them. Project is taken in the state there are different aspects of ITK based DSS. (Yost *et.al.,*1992). Meghalaya state selected purposely because its climate is suitable for both vegetable and fruits then District Ri-Bhoi was selected purposively because Institute is located in this district more over institute is working in these villages already so quick feedback will be taken if these villages will be selected as the study area for the project. (K.J.Boote *et.al.,*) Five villages viz: Mynan, Nonglakhia, Nongkya, Nongthymmai, Kyrden were selected purposely from the Meghalaya which are growing both fruit and vegetables. Profile information of these villages in respect of fruits and vegetables cultivation were collected through secondary data. Then 20 farmers were selected from each village. A decision support system based on the bottom up and participatory approach is a better one as compared to others. (J.D Cain)It provides problem based area specific solution .Thus this type of PBDSS is more practical and has more adaptability among the farmers. Collection of primary data ensures participation of the farmers in the designing of the PBDSS thus making it Participatory, area specific, problem oriented. (M. Narayana Reddy)

1. Introduction

Decision support system since Its application during early 70s has undergone a logical transformation to an innovative method i.e. Integrated Decision Support System (IDSS) and then to Participatory Decision Support System (PDSS) for effective problem solving technology dissemination process (Guerra Zubiaga *et.al.,* 2006) because of lack of farmers' participation in its designing this excluded problems faced by farmers in cultivation of different crops. This failure of different DSS in solving the farmer's problem led to involvement of the farmers in the designing of the DSS in the form of the PDSS (Participatory Decision Support System). Kristensen K *et.al.,* 2002,While designing PDSS participation of the farmers ensured by providing interview schedule provides data about the socio-economic and technical problems faced by them .O. W. Morgan, Then these issues are being addressed by incorporating the solution of these problems

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while designing the PDSS. This type of the DSS will be based on the area specific, problem oriented, participatory and bottom up approach which makes the DSS user friendly, interactive, solution oriented and practical (Kosaka T *et.al.,*1994). Incorporation of different mobile apps, success stories, developmental schemes. News highlights and FAQs make the PDSS to be more popular among the ICT enabled farmers (R.M. Crassweller *et.al.,* 1993) PDSS can be used by the farmers through phones (android) by installing apps related to it, since most of the farmers do not have access to internet enabled computer system and it is not possible to install kiosks in every village due to lack of funds. Demonstration on how to use the PDSS could be provided at the institute or farmers field through kiosks, internet enabled laptop/desktop/tablets /mobiles etc. (Nutt PC *et.al.,* 2007) In PDSS, there was scope of feed- back analysis, based upon which the problems were diagnosed and solutions were incorporated for better output (Jakku *et.al.,* 2010). Importance of PDSS in the growth of the farming sector needs to be highlighted followed by importance of horticulture in Meghalaya vis-a-vis India. How the PDSS will address the issues of concern. Agricultural decision support systems (Agri DSS) will be a major contributor in the realization of a viable farm economy with less negative environmental impact, but it must not only provide current and relevant information. Current PDSSs available to farmers, advisors, experts, and policy makers are not used to their full potential. One reason is that they fail to capture the actual needs of the farmers and to understand their decision-making in practice. They are not adapted to the high complexity characterizing sustainable land use decision-making. Among farmers the acceptance of these systems are low, partly because existing DSS are based on what scientists and system developers consider as necessary. As a result, new linkages and better under-standing between different stakeholders in agriculture has to be improved. (Jessica Lindblom *et.al.,* 2014).
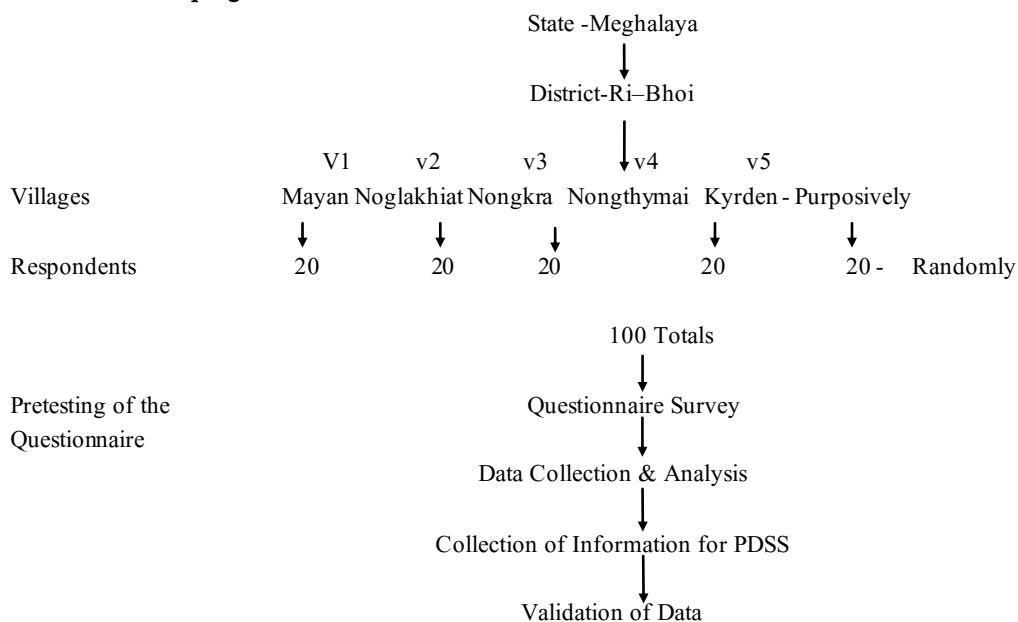
2. Material and methods

The agro-climatic situation of Meghalaya needs to be depicted with respect to horticulture (different types of prominent horti crops, production, productivity etc.). The technological intervention in horticulture by ICAR RC NEH because its climate is suitable for vegetable , fruits and spices then District Ri-Bhoi was selected purposively

as the study locale for survey and collection of data in respect of fruit and vegetables, because Institute is working in these villages already so quick feedback will be getting if these villages will be taken as the study area for the project 5 villages viz: Mynan, Nonglakhia, Nongkya, Nongthymmai, Kyrdenwere selected purposely from the Meghalaya which are growing both fruit and vegetables. Profile information of these villages in respect of fruits and vegetables cultivation were collected through secondary data.Then 20 farmers were selected from each village. Who are growing both fruits and vegetables? Among fruits Data has been collected from famers through interview schedule, thus making a sample size of 100 farmers for this study. Further selection of important fruits and vegetables to be included in the DSS was finalized on the basis of certain parameters like maximum area coverage, yield potential, marketing scope, post harvesting scope, technology availability, source of information, germplasm availability, farmers' preference, inheritance from generation to generation, etc. through interview with farmers. Technology packages of five vegetables and five fruits have been compiled keeping view on the farmers' perception and understanding. Constraints were measured and different aspects were from farmer through interview schedule then these constraints were ranked cranked according to Garret Ranking Technique.

Designing of PDSS:

Similarly, to other systems, PDSS systems require a structured approach. Such a framework includes people, technology, and the development approach. The participatory Framework of Decision Support System consists of four phases Intelligence – Searching for conditions that call for decision; Design – Developing and analyzing possible alternative actions of solution; Choice – Selecting a course of action among those; Implementation – Adopting the selected course of action in decision situation. PBDSS technology levels (of hardware and software) includes: a) the actual application that will be used by the user. This is the part of the application that allows the decision maker to make decisions in a particular problem area. The user can act upon that particular problem's b) Generator contains Hardware/software environment that allows people to easily develop specific DSS applications. This level makes use of case tools or systems c) Tools includes lower level hardware/software. PBDSS generators including special languages function libraries and linking modules. An iterative developmental modules. An iterative

Flow chart: 1 Sampling Plan

State -Meghalaya

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District-Ri–Bhoi

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	V1	v2	v3	v4	v5
Villages	Mayan	Noglakhiat	Nongkra	Nongthymai	Kyrden - Purposively
Respondents	20	20	20	20	20 - Randomly

100 Totals

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Pretesting of the Questionnaire   Questionnaire Survey

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Data Collection & Analysis

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Collection of Information for PDSS

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Validation of Data

developmental approach allows for the DSS to be changed and redesigned at various intervals. Once the system is designed, it will need to be tested and revised where necessary for the desired outcome. (Wikipedia)

3. Results and discussion

Pineapple is the principle horticulture crop grown in Meghalaya it is used for the juice extraction, jam making, raw eating etc. Similarly, papaya is grown in the Meghalaya as local and hybrid varieties it is used as raw and the ripe. Similarly, black pepper, ginger and turmeric also grown in the state as spices. Among vegetables broccoli, capsicum okra and cucumber are grown widely.

Table: 1. Profile information of these villages in respect of fruits and vegetables cultivation was collected through secondary data (Source, Year)

Results on certain parameters need to be given may be in frequency and percentage. Comparison between the perception of beneficiaries w. r.t. different villages and preference for different crops for information.
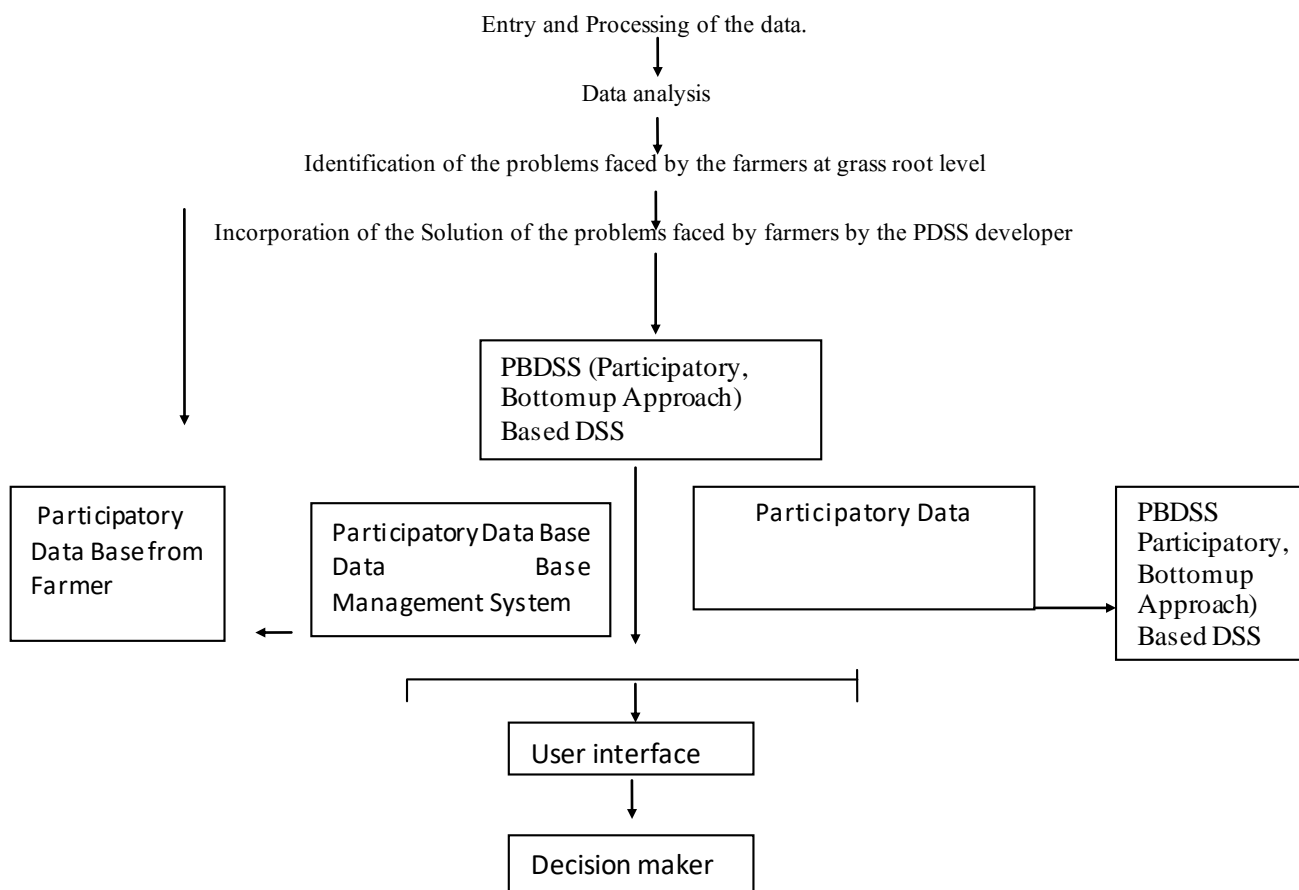
Most of the farmers of the selected villages are growing vegetables in Rabi season and fruit crops and maize and rice in kharif crop, having small land holdings, both upland and lowland ecosystem, having acidic soils, most of the farmers lacking awareness about soil testing, rainfall is source of irrigation for kharif crops and jalkund as a source of irrigation for Rabi crops, furrow method of irrigation is adopted by vegetable growers, and drip method is used by the fruit growers. Good quality Seed or planting material for horticulture crops is being provided by the ICAR. (Hammer G *et.al.*, 2002). Multi cropping is followed by the most of the villagers. Fruits and vegetables has maximum yield potential in the villages, most of the farmers are not satisfied with the yield of the fruit and vegetables, products are sold in the local market and Shillong. Price fetched by the farmers is not satisfactory.

Vegetables, fruits and spices have maximum marketing potential in the village. Among fruits maximum area coverage and yield potential is found in pine apple. Growing, selling and processing preferences are also found in pineapple. Local, improved and hybrid germplasm is also available for pineapple. In technology availability propagation, spacing, planting, intercultural operation and processing related technology is available for pineapple. There is good marketing scope is available for both pineapple and banana in local market and through middleman. A decision support system based on the bottom up and participatory approach is a better one as compared to others. (N.Haie *et.al.*, 1988) Participation of the farmers is ensured in selection of the priority attributes. It provides problem based solution which is area specific, thus this type of DSS is more practical and have more adaptability among the farmers. (Broneret *et al.*, 1990). Collection of primary data ensures participation of the farmers in the designing of the DSS thus making it Participatory, area specific and problem oriented.

Flow Chart: 2 Designing of Participatory, Bottom up Approach based DSS.

Collection of primary data from the vegetable, fruits growing farmers through interview schedule

Entry and Processing of the data.

Data analysis

Identification of the problems faced by the farmers at grass root level

Incorporation of the Solution of the problems faced by farmers by the PDSS developer

PBDSS (Participatory, Bottomup Approach) Based DSS

Participatory Data Base from Farmer	Participatory Data Base Data Base Management System	Participatory Data	PBDSS Participatory, Bottomup Approach) Based DSS

User interface

Decision maker

Table: 1.Profile information of these villages in respect of fruits and vegetables cultivation was collected through secondary data (Source, Year)

S.No.	Crop	Area in Ri -Bhoi	Area in Meghalaya	State Share %	Rank
Fruits					
1.	Pineapple	3669	10766	34.07	I
2.	Papaya	160	643	24.88	II
3.	Banana	898	6919	12.97	IV
4.	Khasi mandarin	233	8323	2.79	VI
5.	Assam leman	45	1042	4.31	V
6.	Strawberry	19	94	20.21	III
Spices					
1.	Black pepper	147	911	16.13	I
2.	Ginger	979	9461	10.34	II
3.	Turmeric	121	2000	6.05	III
4.	Chilli	93	1893	4.918	IV
Vegetables					
1.	Broccoli	57	183	31.14	I
2.	Capsicum	90	442	20.36	II
3.	Okara	83	427	19.43	III
4.	Cucumber	88	508	17.32	IV

Table: 2: Parameters to be included in selecting Vegetables, Fruits and Spices.

Priority attributes		V1	V2	V3	V4	V5
Technology availability	F	Pineapple	Pineapple	Papaya	Pineapple	Citrus
	V	Broccoli, Cucumber, Capsicum, Bitter guard				
	S	Zinger,Turmeric,Chilli				
Source of information	F	Pineapple,Papaya,Citrus				
	V	Broccoli,Cucumber,Capsicum,Bitterguard				
	S	Zinger,Turmeric,Chilli				
Farmers' preference	F	Pineapple	Pineapple	Papaya	Banana	Citrus
	V	Broccoli	Bitter guard	Capsicum	Broccoli	
	S	Zinger	Zinger	Zinger	Turmeric	Chili
Germ plasm availability	F	Pineapple	Pineapple	Banana	Papaya	Banana
	V	Broccoli, Bitter guard, Capsicum				
	S	Zinger		Turmeric		
Maximum area coverage.	F	Pineapple	Papaya	Banana	Papaya	Pineapple
	V	Broccoli	Capsicum	Okra	Capsicum	Cucumber
	S	Zinger	Zinger	Turmeric	Zinger	Black pepper
Yield potential	F	Pineapple	Banana	Papaya	Citrus	Pineapple
	V	Cucumber	Broccoli	Capsicum	Broccoli	Bitter gouard
	S	Turmeric	Black pepper	Zinger	Zinger	Turmeric
Market scope	F	Pineapple,Papaya,Banana				
	V	Broccoli	Cucumber	Bitter gourd	Okara	Cucumber
	S	Turmeric , Zinger , Black pepper				
Post harvesting scope	F	Pineapple				
	V	Capsicum				
	S	Turmeric ,Zinger, Black Pepper				

F=Fruits, V=Vegetable, S=Spices   V1, V2, V3, V4, V5 = Village =1, 2,3,4,5

Keeping in mind above constraints related to DSS system developed is farmers friendly and bottom up approach based, based on the problems of the farmers and end up with the farmers problem and ended with the development of the technology based on these problems and includes the problems of the farmers in the development of these problems (Hammer et.al., 2002) Among infrastructural constraints first one is the lack of roads connectivity to the market so while developing D.S.S. It has been kept in mind that good roads should be there from production point to the selling point (market) shortest and good roads are provided. (Hatchuel A, Weil B et al., 2009). Among economic constraints higher input value of seeds and planting material. Among them cheaper value seed and planting material are provided to the farmer through state department and rational value seed shops are provided to the farmers in DSS development.

(Breuer N, et.al., 2008) Second farmers view also provided in the development of the DSS. For which nearest retail shop is credible for the farmers for the sell of the seeds. (Cox P et.al.,1996) Among technical constraints major problem was the lack of computer awareness among the farmers it was kept in mind that DSS was designed in lucid language and farmer's friendly content. (Brancourt et.al., 1999) Among physiographic constrains hills are the major constrains for the farmers. So while developing technologies /suitable for hill farming as told by the farmers will be used for DSS development among socio-cultural constraints farmers do not want to discontinue the age old practices of farming because of that do not want to use the new practices such as the D.S.S. or other methods. To makes the DSS Socio-culturally farmers friendly. Farmers are providing the practices which are used by them.

Table 3. Constraints faced by the PBDSS developer. (Hubert B *et.al.,* 2009)

S.No.	Infractural Constraints.	Rank	II
1.	Lack of Road connectivity for market.	I	
2.	Lack of Android phones /Smart Phones.	III	
3.	Higher Installation Cost of the DSS.	II	
4.	Lack of Marginal Land Holding.	IV	
5.	Lack of the planting material	v	
6.	Lack of the processing facility	VI	
S.No.	Economic Constraints.		III
1.	Higher Input value of Seed Planting Material.	I.	
2.	Higher Cost of Android Mobile Smart Phones.	III	
3.	Higher initial Cost of Installation of Kiosks.	IV	
4.	Lack of Money in Hand.	II.	
S.No.	Technical Constraints.		I
1.	Lack of e-literacy among the farmers.	IV	
2.	Lack technical knowhow of computer operating and mobile use.	III.	
3.	Lack of availability of content of P.D.S.S. in local language.	II	
4.	Lack of computer awareness.	I	
S.No.	Physiographic Constraints.		IV
1.	Small holding of farmers.	II	
2.	Terrace Farming.	IV	
3.	Hills /Mountains, making, accessibility Difficult.	I	
4.	Round the Year Rainfall.	VI	
5.	Bad Roads with Potholes	V	
6.	Remoteness /interiority of the orchards /farms /field.	III	
S.No.	Socio-Cultural Constraints		V
1.	Social structure demoralises use of the ICT tools.	IV	
2.	Fear of advanced technology.	III	
3.	Believe in jhoom cultivation.	II	
4.	Do not want to discontinue the age old practices of cultivation.	I	
5.	There no alternative to Jhoom cultivation in Meghalaya.	V	

4. Conclusions

PBDSS generators including special languages function libraries and linking modules. An iterative developmental approach allows for the PBDSS to be changed and redesigned at various intervals. Once the system is designed, it will need to be tested and revised where necessary for the desired outcome. So all these constraints are kept in mind while developing the participatory and bottom up approach based PBDSS. This will address major issues of the fruits, vegetables and spices growers. Thus by including suggestions of the farmers by ensuring their participation in the development process of the DSS it has been made participatory and bottom up approach based. (Cox P et.al 1996) Among constraints technical constraints were the main followed by the Economic, Infrastructural, Physiographic and Socio-Cultural Constraints. Hubert B et.al 2009 For example if we want to know that which fruit orchard to be established in Meghalaya then this DSS will tell that based on the priority attributes (e.g.. Technology availability, Market information) and constraints present the state pineapple followed by papaya and banana is better. Similarly, among vegetables broccoli followed by capsicum is better and based on the suggested criteria among spices black pepper followed by turmeric and ginger are better.

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