Discovery

Management information system, needs of farmers in Nagpur district: a study

Vilas N Hajare[1], Kishore V[2]

1.Tirpude Institute of Management Education, Nagpur, India
2.Ghormade, Taywade College, Koradi, Nagpur, India

General Note

Article is recommended to print as color digital version in recycled paper.

ABSTRACT

The study aims to assess the Management Information System needs of the farmer. The methodology used is questionnaire based survey for Nagpur district, Maharashtra. Application of MIS can improve the effectiveness of sales and purchase management in agribusiness. However most of the required agricultural information is not in easy access to the farmers. Therefore, application of ICT-based agriculture information support systems is very much important for the dissemination of agricultural information and technological knowhow by rural farming community. To betterment of information systems in agriculture it is highly recommend to establish communication between farmers, coordinators, agricultural experts, research centers, and community by information technology. The information must be based on farmers' needs, internet used as a mode to transfer the advanced agricultural information to the farming community. Farmers can be illiterate and speak a local language and they are not expected to use the system directly respectively. MIS provides information about Weather forecasting, fertilizers, purchase and sales Market information systems, government subsidy and accurate technical and management information's.

Keywords: MIS, Farmer, Communication, Agribusiness, Information system.

1. INTRODUCTION

Management Information Systems (MIS)

It is basically a computer based record keeping information system which helps to improve the decision abilities. Once a decision has been taken that a strategic grain reserve should be established the requirements and the various options open to government to meet those requirements need to be considered. Decisions will need to be taken concerning the mechanisms required for monitoring market conditions, and the ownership, structure, size, location and financing of the reserve. When the grain market was a government controlled monopoly the marketable surplus was normally purchased soon after harvest. The quantities of grain available to meet market requirements would be known and thus, in years of poor production, the expected shortfall which would need to be covered, either by imports or by a reduction of stocks. Under a free market the quantities of grain marketed, held in store, either on-farm or in traders'/millers' warehouses, is unknown, and not possible to obtain with any degree of reliability1 Foreign trade arrangements made by the private sector would also not be known unless special arrangements have been made, e.g. through a system of import/export licensing. Government is therefore increasingly forced to rely on secondary data to monitor the current and expected market conditions. This would involve the use of market prices, price trends and movements as a proxy for assessing market availabilities. Thus, as liberalization proceeds, the government will become increasingly dependent on the collection and analysis of statistical data if it is to keep abreast of market conditions and be able to assess likely future market developments. This will require that greater attention is given to improving the quality and reliability of production forecasts and on the development of market information and early warning systems than has been common in the past. The less reliable the available information is, the greater will be the degree of uncertainty in the assessments of the likely market developments, and thus the greater will be the provision which will have to be made to ensure that the market will be adequately catered for. Governments have been traditionally unwilling to make the necessary investments in developing and maintaining effective information systems in the firm belief that they cannot afford the resources. However, it needs to be remembered that such information systems can, by providing reliable information; help the government avoid the high costs of coping with an unexpected, or poorly prepared for, food emergency. Clearly the reliability of the information systems available to government relating to production and market forecasts will have a direct bearing on the size of the strategic grain reserve needed to give the required degree of protection.

Crop production forecasts

Estimates of the production of key crops are usually made during the growing season based on area planted and expected yield. These estimates are finalized following harvest when the results of crop cutting surveys are normally also included in the calculations. However, the reliability of these estimates varies considerably between countries. With market liberalization the timeliness and reliability of production forecasts for basic food production becomes increasingly important to government as an early indicator of the likely food situation facing the country in the coming marketing year.

Market information systems

The establishment of a market information system for use by both government and traders which provides regular information through the media on the prevailing market prices and availabilities needs to be given a high priority by government in its market liberalization policy.

Need for the information to farmers

The main focus of ICT in agriculture is meeting the farmers' needs for information. It is given as follow:-

- Information Regarding Marketing
- Facilitating access to various land records/online registration
- Question-and-answer service
- Information about rural development programmes and subsidies
- Weather forecasting
- Latest (best) packages of practices
- Post-harvest technology
- General agricultural news
- Information on crop insurance
- Farm business and management information
- Input prices and availability
- Early warning and management of diseases and pests

Software: Applications of Agriculture MIS

The IT project section, in coordination with NIC (Govt. Of India), has launched several important software applications for supporting farmers. Some software are:

Rainfall Recording & Analysis

Web based application to record daily rain values of every Taluka in the State. Software is in use since 1998. Circle wise rainfall data capturing is implemented from April 2014. Rainfall Recording & Analysis has won the Skoch Order of Merit 2014.

eThibak

eThibak is an online platform for subsidy proposal submission by farmers under the National Mission on Micro Irrigation (NMMI) scheme. The subsidy is disbursed by issuing a cheque in the name of farmer. Facility of direct transfer of subsidy to farmers' account can be implemented. eThibak has won the Skoch Order of Merit 2014.

eParwana

eParwana has won Skotch Order of Merit, 2014 & 2013, State eGovernance Award, 2013, eMaharashtra Award 2013 and eIndia Award 2012 .

CROPSAP

CROPSAP has won the National eGov Award, 2011-12. The project was launched for effective disease and pest control. It includes field observations, accurate diagnosis followed by timely advisory to farmers over SMS.

Agriculture Census

Agriculture Census project involves integration with Land Records database to get data regarding farmers such as name of land owner, survey no., cultivated and non-cultivated area, holding type (individual, joint, institutional), land holding in other village of same Tehsil etc. The integration system was developed by NIC Pune.

Kisaan SMS Service

DAC has developed farmer portal (www.farmer.gov.in), intended to be an integrated portal for providing services to farmers. Kisaan SMS service was launched on July 16, 2013 from farmer portal for providing SMS advisory to farmers. Database of 15.47 Lakh farmers has been uploaded on Kisaan SMS portal. From Maharashtra, till 14th September 2014, total 28,754 advisories have been sent, benefitting 11,14,04,358 farmers.
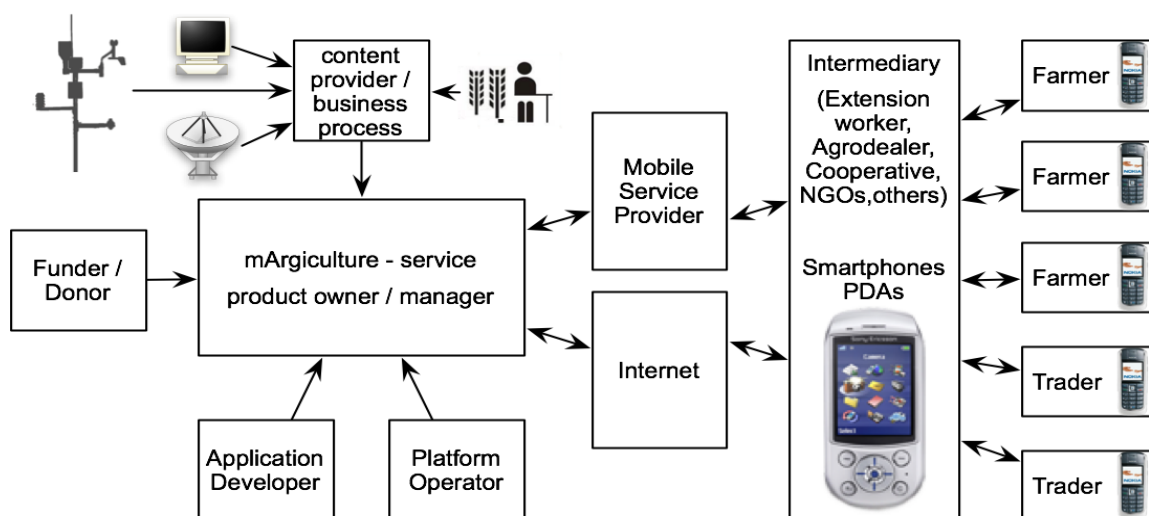
mAgriculture

mAgriculture is a subset of eAgriculture, referring to the delivery of agriculture - related services via mobile communications technology. Mobile communication technology includes all kinds of portable devices like basic mobile phones, smartphones, PDAs or tablet devices (e.g. iPad) mAgriculture can also involve gathering relevant data through mobile technologies like automated weather stations (AWS) or systems and sensors for location-based collection.

List of government schemes for agriculture in India

There are useful links to avail various Citizen Services being provided by the Central and State/UT Governments in India. The list, however, is not exhaustive, as more and more information about other services can be found for farmers & farming base businesses. Only short list is given there.

Table 1.1 Schemes related to Central Ministries

Central
• National Bio-Science awards for career development
• Agricultural Census
• Jute Technology Mission
• Technology Mission on Cotton (Mini Mission III & IV)
• Rashtriya Krishi Vikas Yojana (RKVY)
• Livestock Insurance Scheme
• National Scheme on Welfare of Fishermen
• Scheme on Fisheries Training and Extension
• Gramin Bhandaran Yojna
• Central Assistance to State Plan Scheme on Watershed Development
• Capacity Building to enhance Competitiveness of Indian Agriculture and Registration of Organic Production

Table 1.2 Schemes related to State Departments

State	Schemes
Maharashtra	• Tree Planting on Community Lands in Identified Watersheds • Western Ghat Development Programme • NABARD-WDF Assisted Watershed Development Programme • River Valley Project • Gram Sachivalaya Yojana (GSY)

Table 1.3 Scheme: Accelerated Pulse Production Programme (A3P)

Theme Name	Type of Assistance	Pattern of Assistance
Plant Protection	Support for Fungicides for seed treatment , pesticides, bio-control agents, NPV (Virus), organic pesticides, pheromone trap etc. for Pulse production	Upto ` 860 to ` 1450 per unit per hectare.
Training and Extension for Farmers	Cluster demonstration of Pulses	Full cost of Input

Table 1.4 Scheme: Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds

Theme Name	Type of Assistance	Pattern of Assistance
Seeds	Assistance for boosting seed production in private sector including individual/ entrepreneurs, self help groups etc.	Credit linked back ended capital subsidy at the rate of 25% of project cost limited ` 25 lakh per unit

2. LITERATURE REVIEW

Naidoo and Rolls (2000) also investigated agricultural information use by small-scale cattle farmers in Mauritius and found that the farmers managed information as a production resource. The personal characteristics and cattle husbandry practices of the farmers were major influences on their management of information. The practices were mainly learnt from family elders. Extension advice was only partly remembered, or rejected as the information from this source was sometimes not useful. In contrast to the farmers networks analyzed at the micro level by Hoang et al. (2006), Morone et al. (2006) researched information diffusion and social networks in the organic food sector in the province of Foggia, Italy. They found that the organic sector was becoming more complex, presents a challenge for organic farms and firms to overcome these changes. They also studied the role of institutions in diffusing information to the producers and identified the crucial information needs and gaps. Recently, there have been some studies on the use of the digital information systems and technologies in the agricultural and food sectors. Šilerová and Lang (2006) discussed the usage of the information systems and the expansion of the portals in the rural sector. The development of the information systems and its implementation with the portal solutions enable a web access to the information and the effective management and administration (Šilerová and Kučírková, 2008). Similarly, Kučera and Látečková (2006) pointed out the importance of information systems concerning the solutions by the computer software and the expertise systems in agriculture and food sectors. These systems help to make decision and contribute to the information management. Mistr (2007) also stressed that the future of the information systems will have to be designed as user-friendly computer programs and portals in the agricultural information systems. Dařena (2007) applied the information systems theory to marketing and established marketing information systems to support and manage marketing activities.

3. RESEARCH METHODOLOGY

This study primarily deals with identifying the Management Information System in the context of Food grains in Nagpur District. In this study, the researcher has taken responses from 485 Farmers of Nagpur District. This study primarily highlights the various factors which affect the application of MIS. This study also checks the feedback of Farmers on the MIS on their crop.

3.1. Objectives of research

Main objectives of the proposed research are:
• To assess the general agricultural information's needs of farmer
• To study the effectiveness of Applications of MIS in sales and purchase of Agricultural products.
• To study the information flow from MIS destination to farmer.
• To study the government schemes for agriculture (Farmers)

3.2. Hypothesis

Application of MIS can improve the effectiveness of sales and purchase management in agribusiness.

3.3. Data collection

In the present study, Primary Data is collected from different farmers of the Nagpur District. We have used Questionnaire (Interview for illiterate farmers) designed in local language (deonagari) as well as in English, where the data is collected form 485 farmers of Nagpur District.. A simple random sampling is used as per the availability of the data. Secondary data is collected from sources like journals, magazines, publications, websites of different government agencies, TV programs and other literature available as per requirements.

3.4. Limitations of the study

1.The universe of study is limited to Nagpur District. It may not be the exact representation of the globe.

2.Sample size is restricted to 485 respondents. This limits the study to one particular region.

3.5. Data analysis

3.5.1. The statistical tools and Analysis:

1.The 5 point Likert's scale is used to collect the responses where every Likert's item is provided the given weights: 1-Strongly agree, 2-Agree, 3-Neither agree nor disagree , 4- Disagree and 5-Strongly disagree.

2.Cronbach's alpha reliability test as to check the internal consistency of items under consideration of a subject.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} \sigma_{Yi}^2}{\sigma_X^2}\right)$$

Where :   K= number of different items administered to each subject.

σ_{Yi}^2 = Variance of different items administered to each subject.

σ_x^2 = Variance of total raw scores of each sample respondent.

3.Measure of Dispersion mainly Standard Deviation as to identify the internal variability in each item.

4.Skewness which determine the asymmetrical distribution.

5.Z statistics right tail test for a large sample i.e..

Table 1 Application of MIS can improve the effectiveness of sales and purchase management in agribusiness

Q.No.	Factor	1. Strongly Agree	2. Agree	3. Neither	4. Dis-Agree	5. Strongly Disagree	Total	Mean	Median	Mode	SD
1	Freq.	101	169	86	75	54	485	2.61	2	2	1.28
	%age	20.82	34.85	17.73	15.46	11.13	100.00				
2	Freq.	87	179	73	78	68	485	2.71	2	2	1.31
	%age	17.94	36.91	15.05	16.08	14.02	100.00				
3	Freq.	78	199	87	63	58	485	2.64	2	2	1.24
	%age	16.08	41.03	17.94	12.99	11.96	100.00				
4	Freq.	39	44	53	189	160	485	3.80	4	4	1.22
	%age	8.04	9.07	10.93	38.97	32.99	100.00				
5	Freq.	184	199	34	39	29	485	2.03	2	2	1.14
	%age	37.94	41.03	7.01	8.04	5.98	100.00				
6	Freq.	184	228	39	24	10	485	1.86	2	2	0.91
	%age	37.94	47.01	8.04	4.95	2.06	100.00				
7	Freq.	201	233	27	16	8	485	1.76	2	2	0.83
	%age	41.44	48.04	5.57	3.30	1.65	100.00				
8	Freq.	165	175	44	69	32	485	2.23	2	2	1.24
	%age	34.02	36.08	9.07	14.23	6.60	100.00				
9	Freq.	150	165	58	68	44	485	2.36	2	2	1.29
	%age	30.93	34.02	11.96	14.02	9.07	100.00				
10	Freq.	112	136	63	92	82	485	2.79	2	2	1.42
	%age	23.09	28.04	12.99	18.97	16.91	100.00				
11	Freq.	131	126	82	68	78	485	2.66	2	1	1.42
	%age	27.01	25.98	16.91	14.02	16.08	100.00				
12	Freq.	126	136	87	73	63	485	2.61	2	2	1.36
	%age	25.98	28.04	17.94	15.05	12.99	100.00				
13	Freq.	112	131	82	87	73	485	2.75	3	2	1.38
	%age	23.09	27.01	16.91	17.94	15.05	100.00				
14	Freq.	121	141	63	92	68	485	2.68	2	2	1.39

	%age	24.95	29.07	12.99	18.97	14.02	100.00			
15	Freq.	126	126	82	73	78	485	2.69	2	2	1.41
	%age	25.98	25.98	16.91	15.05	16.08	100.00			
16	Freq.	102	136	87	78	82	485	2.80	3	2	1.38
	%age	21.03	28.04	17.94	16.08	16.91	100.00			
17	Freq.	204	184	44	29	24	485	1.94	2	1	1.09
	%age	42.06	37.94	9.07	5.98	4.95	100.00			
18	Freq.	194	213	29	27	22	485	1.91	2	2	1.04
	%age	40.00	43.92	5.98	5.57	4.54	100.00			
19	Freq.	126	126	73	82	78	485	2.71	2	1	1.42
	%age	25.98	25.98	15.05	16.91	16.08	100.00			
20	Freq.	136	161	53	70	65	485	2.52	2	2	1.38
	%age	28.04	33.20	10.93	14.43	13.40	100.00	$\bar{x}$			σ=s
Overall	Freq.	2679	3207	1246	1392	1176	9700	2.50	2	2	1.35
	%age	27.62	33.06	12.85	14.35	12.12	100.00	Overall percentage is about 60.68%			

3.5.2. Testing the hypothesis using Z statistics

Decision Rule : Since two tail test, if -Ztab<Zcal<Ztab we accept Null Hypothesis at 5% level of significance , otherwise reject Null Hypothesis and accept Alternative Hypothesis. Secondly if Alternative Hypothesis is accepted then on the basis of sample mean we can determine the influence of either improvement (if $\bar{x}$<3) or lower (if $\bar{x}$>3) the effectiveness of sales and purchase management in agribusiness.
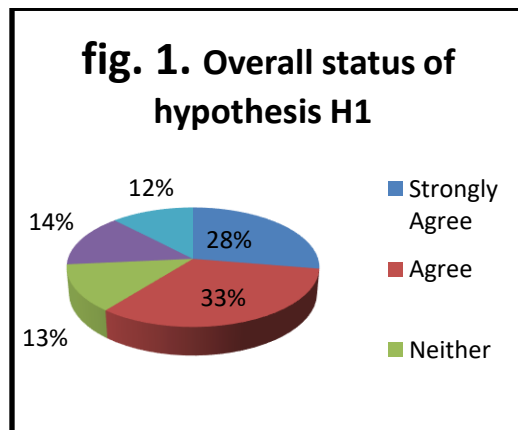
Given data:

Number of respondents m=485, Number of factors under consideration k =20, sample size n=m*k =9700, sample mean $\bar{x}$= 2.50 , population mean μ = 3, std. deviation σ =1.35 .

Z statistics is defined as

$$Z_{cal} = \frac{\bar{x}-\mu}{\sigma/\sqrt{n}} \qquad = -36.47,$$ where n≥30 Large sample two tail test.

Ztab= ± 1.96 at 5% level of significance.

fig. 1. Overall status of hypothesis H1

(Strongly Agree 28%, Agree 33%, Neither 13%, 14%, 12%)

3.5.3. Interpretation of z test & Data interpretations

Since two tail test, Zcal<-Ztab we reject Null Hypothesis at 5% level of significance and accept the alternative Hypothesis H11, which is obvious for 1% and 10% level of significance. On the basis of sample mean since $\bar{x}$= 2.50 i.e $\bar{x}$<3, indicates some positive believe of improvement the effectiveness of sales and purchase management in agribusiness. We can conclude that the farmers are

moderately in favor of the hypothesis H1: Application of MIS can improve the effectiveness of sales and purchase management in agribusiness.

3.5.5. Interpretation

Almost 61% of farmers believe that application of MIS can improve the effectiveness of sales and purchase management in agribusiness. However 39 % farmers are not agreeing that application of MIS can improve the effectiveness of sales and purchase management in agribusiness. In this case 39 % is a huge population who are dissatisfied. Reliability & Accountability of MIS should enhance in order to satisfy the needs of maximum farmers.

fig.2. factorwise effectiveness of applications of MIS in sales and purchase of agricultural products
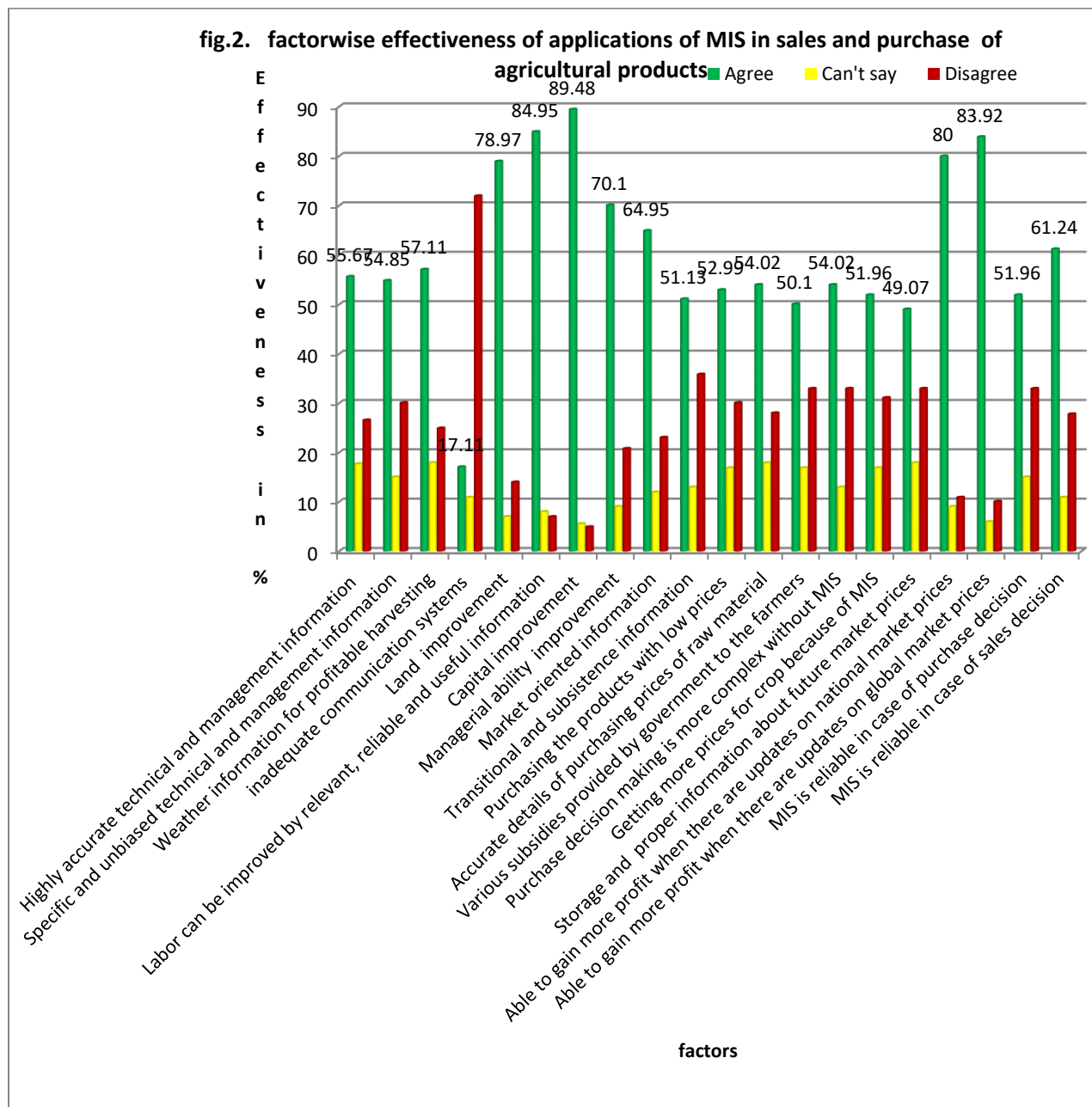
4. FINDINGS

Findings (from fig. 2) of our research are as follows:

Almost 56% of farmers believe that MIS provides highly accurate technical and management information and advice in direct response to the needs. However 44% farmers are not agreeing to the accuracy of the MIS in providing information & advice in direct

response to the needs. In this case 44 % is a huge population who are dissatisfied. Reliability & Accountability of MIS should enhance in order to satisfy the needs of maximum farmers.

Almost 55% of farmers believe that MIS provides specific and unbiased technical and management information and advice in direct response to the needs. However 45% farmers are not agreeing of the MIS provides specific and unbiased technical and management information and advice in direct response to the needs. In this case 45 % is a huge population who are dissatisfied. MIS should provide specific and unbiased technical and management information and advice in direct response to the needs of farmers.

Almost 57% of farmers believe that weather information helps them in profitable harvesting. However 43 % farmers are not agreeing that weather information helps farmers in profitable harvesting. In this case 43 % is a huge population who are dissatisfied. Reliability & Accountability of MIS information should enhance in order to satisfy the needs of maximum farmers.

Almost 72% of farmers disagree with the fact that there are inadequate communication systems for necessary statistics under MIS. . In this case 72 % is a huge population who are dissatisfied. Adequate communication system should be provided for MIS statistics.

Almost 79% of farmers believe that land can be improved by relevant, reliable and useful information. However 21 % farmers are not agreeing that Land can be improved by relevant, reliable and useful information. In this case 21 % population is dissatisfied; MIS is working well in this case. Relevant information should be provided so that condition of land can be improved effectively.

Almost 85% of farmers believe that labour can be improved by relevant, reliable and useful information. However 15 % farmers are not agreeing that labor can be improved by relevant, reliable and useful information. In this case 15 % population is dissatisfied; MIS is working well in this case. Depending upon the labor condition the MIS information should be provided.

Almost 89% of farmers believe that capital can be improved by relevant, reliable and useful information. However 11 % farmers are not agreeing that Capital can be improved by relevant, reliable and useful information. In this case 11 % population is dissatisfied; MIS is working well in this case. Reliability & Accountability of MIS should enhance in order to satisfy the needs of maximum farmers.

Almost 70% of farmers believe that managerial ability can be improved by relevant, reliable and useful information. However 30 % farmers are not agreeing that Managerial ability can be improved by relevant, reliable and useful information. . In this case 30 % is a huge population who are dissatisfied. Accountability of MIS information should enhance in order to satisfy the needs of maximum farmers.

Almost 65% of farmers believe that MIS provides them market oriented information. However 35 % farmers are not agreeing that MIS provides farmers market oriented information. In this case 35 % is a huge population who are dissatisfied.MIS should provide market oriented information.

Almost 51% of farmers believes that MIS provides transitional and subsistence information. However 49 % farmers are not agreeing that MIS provides transitional and subsistence information. In this case 49 % is a huge population who are dissatisfied.MIS should provide transitional and subsistence information.

Almost 53% of farmers believe that information system helps them in purchasing the products when prices are low. However 47 % farmers are not agreeing that information System helps farmers in purchasing the products when prices are low. In this case 47 % is a huge population who are dissatisfied.MIS should improve forecasting statistics.

Almost 54% of farmers believe that information system provides accurate details of purchasing prices of raw material. However 46 % farmers are not agreeing that Information system provides accurate details of purchasing prices of raw material. In this case 46 % is a huge population who are dissatisfied.MIS should improve forecasting statistics for different types of raw materials.

Almost 50% of farmers believe that MIS provides details about various subsidies provided by government to them. However 50 % farmers are not agreeing that MIS provides details about various subsidies provided by government to the farmers. In this case 50 % is a huge population who are dissatisfied. MIS should provide accurate details about various subsidies provided by government to the farmers.

Almost 54% of farmers believe that purchase decision making is more complex when proper MIS is not available. However 46 % farmers are not agreeing that Purchase decision making is more complex when proper MIS is not available .In this case 46 % is a huge population who are dissatisfied. Looking at the needs of the farmers MIS should be made available to them.

Almost 52% of farmers believe that farmers are getting more prices for their crop because of MIS. However 48 % farmers are not agreeing that farmers are getting more prices for their crop because of MIS .In this case 48 % is a huge population who are dissatisfied. Farmers should be convinced that proper utilisation of MIS will give them the desired results.

Almost 49% of farmers believe that they are able to store the product when there is proper information about future market prices. However 51 % farmers are not agreeing that farmers are able to store the product when there is proper information about

future market prices .In this case 51 % is a huge population who are dissatisfied. MIS should improve forecasting statistics so that farmers will be able to store the product when there is proper information about future market prices.

Almost 80% of farmers believe that they are able to gain more profit when there are updates on national market prices. However 20 % farmers are not agreeing that farmers are able to gain more profit when there are updates on national market prices. In this case 20 % population is dissatisfied, MIS is working well. MIS should provide updates on national market prices.

Almost 84% of farmers believe that they are able to gain more profit when there are updates on global market prices. However 16 % farmers are not agreeing that farmers are able to gain more profit when there are updates on national market prices. In this case 16 % population is dissatisfied, MIS is working well. MIS should provide updates on global market prices.

Almost 52% of farmers believe that they feel that MIS is reliable in case of purchase decision. However 48 % farmers are not agreeing that MIS is reliable in case of purchase decision .In this case 48 % is a huge population who are dissatisfied. Reliability & Accountability of MIS should enhance in order to satisfy the needs of maximum farmers.

Almost 61% of farmers believe that they feel MIS is reliable in case of sales decision. However 39 % farmers are not agreeing that MIS is reliable in case of sales decision. In this case 39 % is a huge population who are dissatisfied. Reliability & Accountability of MIS should enhance in order to satisfy the needs of maximum farmers.

Almost 61% of farmers believe that application of MIS can improve the effectiveness of sales and purchase management in agribusiness. However 39 % farmers are not agreeing that that application of MIS can improve the effectiveness of sales and purchase management in agribusiness. In this case 39 % is a huge population who are dissatisfied. Reliability & Accountability of MIS should enhance in order to satisfy the needs of maximum farmers.

5. CONCLUSION

For carrying out various activities by farmers and rural areas, among other things, information support is also vital. It is found that at moderate level, application of MIS can improve the effectiveness of sales and purchase management in agribusiness. However most of the required agricultural information is not in easy access to the farmers. Therefore, application of ICT-based agriculture information support systems is very much important for the dissemination of agricultural information and technological knowhow by rural farming community. To betterment of information systems in agriculture it is highly recommend to establish communication between farmers, coordinators, agricultural experts, research centers, and community by information technology. Overall, MIS in agriculture is vital for the success of farming. However the efforts need to be taken in order to make it convenient to the farmers. This study is specifically for Nagpur area Farmers .The larger sample of state or nation may be taken in further research for universally accepted results.

REFERENCE

1. "Electronic Information Dissemination through the Farmers' Information and Technology Services (FITS)/Techno Pinoy Program. Bringing Information and Technology within the Reach of the Farmers." from http://jsai.or.jp/afita/afita-conf/2000/part08/p231.pdf, 2000.

2. 18th European Seminar on Extension Education: Supporting Viable Rural Communities, Prague, Czech University of Life Sciences.

3. Ahituv, N., Neumann, S., & Riley, H. N. (1994). Principles of information systems for management (4th ed.). Dubuque, IA: Wm. C. Brown Communications.

4. Aina, L. O. (2007). Globalization and Small- Scale Farming in Africa: What role for Information Centres?. World libraries and information congress 73rd IFLA General Conference and council, Durban, South Africa.

5. Awad, E. M., & Gotterer, M. H. (1992). Database management. Danvers, MA: Boyd & Fraser.

6. Banerjee, U. K., & Sachdeva, R. K. (1995). Management information system: A new framework. New Delhi: Vikas Publishing House.

7. Boyaci, M. (2006). "A Comparison of Conventional and Ecological Agricultural Knowledge Systems in Turkey: Raisin Case." Journal of Sustainable Agriculture, 28: 5–23.

8. Byerlee, D. (1998). Knowledge Intensive crop Management Technologies: Concepts, Impacts, and Prospects in Asian Agriculture. Thailand development Research Institute: Los Banos. Philippines: International Rice Research Institute.

9. Dařena, F. (2007). "Global architecture of marketing information systems – Scientific Information." Agricultural Economics - Czech 53: 432-440.

10. Davis, G.B., & Olson, M. H. (1985). Management information systems: Conceptual foundations, structure, and development. New York: McGraw-Hill.

11. Demiryürek, K. (2000). The analysis of information systems for organic and conventional hazelnut producers in three villages of the Black Sea Region, Turkey, PhD Thesis, The University of Reading, Readings.

12. Demiryürek, K. (2010). "Analysis of information systems and communication networks for organic and conventional

hazelnut producers in the Samsun province of Turkey." Journal of Agricultural Systems.

13. Demiryürek, K., Erdem H., Ceyhan V., Atasever S., and Uysal O. (2008). "Agricultural Information System and Communication Networks: The Case of Dairy Cattle Farmers in Samsun Province of Turkey." Information Research 13: 343.

14. FAO. (2005). Agricultural Knowledge and Information Systems for Rural Development (AKIS/RD).Strategic Vision and Guiding Principles.

15. www.farmer.gov.in