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The role of information in enhancing the agribusiness supply chain performance: A case study of dry chilli

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Abstract

Dry Chilli is one of the most valuable, largely grown and traded commercial crop all over India. Evaluation of Agribusiness supply chain performance of dry chilli depends on how best the different dimensions of cross functional drivers and logistic drivers are practiced. Farmers are one among the channel members of Agribusiness supply chain management. Information plays a vital role for a farmer. An effort was made in this research to bring out the importance of information and its different dimensions, sought by the farmer to make an optimized decision for higher yield and profits in the supply chain. A descriptive research methodology using factor analysis was carried out to bring out the different dimensions of information in agribusiness supply chain management like, Government initiatives and role of horticulture department, frequency of seeking market information, sources of gathering market information, sources of information for crop diseases & to sell at high prices, sources of weather and market information, solution for crop disease and information of cold storage, gathering market information using mobile and land phones.

Keywords: Agribusiness supply chain management, farmer, drivers, information, factor analysis

1. Introduction

India is the world's largest producer, consumer and exporter of dry chillies in the world. India also has the largest area under chillies cultivation in the world. Dry chillies are one amongst the most common spice cultivated in India.

Chillies are valued principally for their high pungency and color. Almost all the states of India produce the crop. The Indian Chilli growing states are Andhra Pradesh (46%), Karnataka (15%), Maharashtra, Madhya Pradesh, Orissa, West Bengal, Rajasthan and Tamil Nadu. Indian chilli can be grown during the entire year at on or the other part of the country. However, the major arrival season extends from February to April.

The crop planting starts from August and extends till October. While, the harvesting begins from December with 5% of the arrivals usually reported in this month. The peak arrivals are reported in February to March. There are several varieties of Indian Chilli and the most popular among these are Sannam, 334, 273, Byadgi, Wonder Hot, Mundu, Teja, Yellow Chillies & Tomato chillies.

India is the largest consumer of Chilli in the world. Around 90% of India's production is consumed within the country. India exports around 80000 – 100000 tons of chillies a year. India exports chillies in the form of dried chillies, Chilli powder, picked chillies and Chilli oleoresin. Indian Chilli is mainly exported to USA, Sri Lanka, Bangladesh, the Middle East and the Far East.

Agri-business supply chain management or agriculture supply chain management includes the key channel members such as farmer, Commission agents, Purchasers/buyers, processing companies, exporting companies and secondary market. The performance of agri-business supply chain management can be evaluated by analysing the role played by each driver.

Supply chain drivers are key to the performance of supply chain constituents and role players across the network. A network is operational only when supply chain drivers are in place. The drivers are the components of the supply chain structure that lead to effectiveness of the supply chain. Logistic drivers (inventory, facilities, transportation), and cross functional drivers information, pricing and sourcing) are the key drivers influencing the agribusiness supply chain performance.

This research identify the critical role of information and its dimensions for a farmer to make decision at various stages of dry chili production and sales so that he can enhance the overall supply chain profit and reduce the degree of risk in producing and selling the dry chilli.

2. Literature Review

2.1 Dry Chilli

Chilli (*Capsicum annum* L.) is most widely used and universal spice of India. (P.P. Jagtap, U.S. Shingane and K.P. Kulkarni 2012) [18]. Chilli is one of the most important commercial crops of India. There are over 50 spices produced in India and good number of them are grown in the country which are indigenous. Among them pepper, cardamom, ginger and turmeric are important. Among spices, a few spices viz., clove, nutmeg, vanilla and certain varieties of chillies were introduced to the country. Many varieties of chilli are grown for vegetables, spices, condiments, sauce and pickles. Chilli occupies an important place in Indian diet. It is an indispensable item in the kitchen as it is consumed daily as a condiment in one form or the other. Among the spices consumed per head, dried chilli fruits constitute a major share (B. C. Rajur, B. L. Patil and H. Basavaraj, 2008) [2].

2.2 Supply chain management

A supply chain is “an integrated process wherein a number of various business entities work together in an effort to acquire raw materials, convert these raw materials into specified final products and deliver these specified final products to retailers”. The supply chain comprises the production and supply of materials and parts, and it serves both the manufacturing logistics chain and distribution logistics chain (Beamon, B.M, 1998) [4]. Supply chain management is the integrated process of producing value for the end user or ultimate consumer. According to Fiala P. (2005) [10] Supply chain partnership leads to increased information flows, reduced uncertainty, and a more profitable supply chain.

According to Monczka *et al.* (2002) [14] “A supply chain can be viewed as a value chain network consisting of individual functional entities committed to the controlled sharing of business data and synchronized coordination of process for optimizing supply chain profit.” Total performance of the entire supply chain is enhanced when we simultaneously optimize all the links in the chain as compared to the resulting total performance when each individual link is separately optimized (Burke and Vakkaria, 2002) [5].

2.3 Agribusiness supply chain management

The Agri supply chains in India and their management are now evolving to respond to the new marketing realities, thrown by the wave of Globalization and other internal changes: like rise in the level of disposable income of consumers, change in the food basket of the consumers towards high value products like fruits, vegetables and animal protein.

The new challenges of the agricultural economy of the country have now spurred the government agencies to go in for different legal reforms for enabling and inviting private investment in agricultural marketing infrastructure, removing different entry barriers to promote coordinated supply chain and traceability (Somashekhar I. C. *et al.*, 2014) [21].

Agribusiness, supply chain management implies managing the relationships between the businesses responsible for the efficient production and supply of products from the farm level to the consumers to meet consumers’ requirements reliably in terms of quantity, quality and price.

In the traditional business model; wholesalers are intermediaries and a predominant link in the retail vegetable logistical chain. In general, all the retailers are inevitably dependent on the local wholesales market. The major constraints are poor transport facilities, non-availability of large scale cold storage, no clean policy guidelines from government and fragmented and small farmers. The fruits and vegetables farming for processing is not only employment intensive, but also enhance the gross as well as net returns of the farmers (B. K. Dileep, R. K *et al.*, 2002, Priya Deshingkar *et al.*, 2003, Tan K.C *et al.*, 1998) [3, 19, 22]. Crop production choices may also be influenced by farming households’ desire to secure consumption from own production, market failures, and roles of state and non-state actors (Umar, 2011) [23].

2.4 Information as a driver

Information is an important driver impacting agriculture supply chain management input decisions. It can be observed that a lot of inefficiencies occur in the farm gate sector because of improper and inadequate information, handled by intermediaries through local grapevines. Further, these intermediaries, who are well entrenched in the system because of the credit mechanism, could distort information at the farm level to suit their own purposes. (Chandrasekaran and Raghuram, 2014) [17]

The government has been initiating a number of initiatives to promote information dissemination over the decades. Agricultural extension service support by governments and universities provide for the improvement of farming economies and the aggressive posture of supply chain networks, as various parties in the network are involved in developing and promoting new varieties, practices, and market reach. (Chandrasekaran and Raghuram, 2014) [17].

It is important to understand the role of information in supply chain efficiency in the agribusiness sector, which has just as much important as in case of manufacturing or assembly business like motor cars. In fact, information is more significant in agribusiness, as it affects the economy and livelihoods more than operational transactions like buying and selling. (Chandrasekaran and Raghuram, 2014) [17].

Adaptations in agricultural practices of small holder farmers has been advanced in both popular and scientific literature as a major vehicle to achieving food security (Armitage *et al.*, 2008; Campeanu and Fazey, 2014; Gohari, 2013; Mubanga and Umar, 2014) [1, 6, 11, 16]. To this end, the need for accurate climate information and efficient early warning might be seen as a means of ensuring smooth and effective farmer adaptation. Information about rainfall intensity and distribution within a particular season has been propagated as a major driver in changing farming methods or farming practices of small holder farmers in rain fed systems (Mortimore and Adams, 2001) [15].

2.5 Role of information in agriculture supply chain management

In today’s business world, information and IT are paramount and needs broad conception to encompass all the

information that business creates, and uses it. A wide spectrum of increasingly convergent and linked technologies helps to process information to collaborate, partner, and co-perform with entities and players across the supply chain, creating value for customers, suppliers, intermediaries and the nodal organization. However the evolution of technology enhanced the contribution of information in enhancing the supply chain performance. In supply chain management of agriculture products like dry chilli, the channel members are keen to gather information to reduce the risk and enhance the profit with respect to production, cultivation, harvesting and trading activities across the field and APMC's.

3. Research Methodology

The study uses both exploratory and descriptive research design to get clarity of research problem and understand the nature of study. The sample size was finalized using the formula $n = \frac{z^2 \sigma^2}{H^2}$ with 95% confidence level and 0.05 level of significance. The sample size finally obtained was 596 farmers trading dry chilli in three APMCs of Karnataka (state), they are Hubballi, Byadagi, and Gadag. The sampling technique used was purposive/ judgmental and convenience sampling method under non-probability sampling techniques while identifying the dry chilli farmers as respondents for the study.

The secondary data required for the literature was collected from APMC website, Horticulture department, Meteorological department, Chilli Board of Karnataka, Journals and Magazines.

The primary data means first-hand information and was gathered with the help of a structured questionnaire in Kannada regional language from the farmers visiting three APMC's for selling dry chilli during January to May 2016. Farmers from different villages of Karnataka were contacted and aptly filled questionnaires were obtained.

Personal interview, Group discussion and Delphi technique were used while conducting pilot study with the farmers. The pilot study helped in identifying the dimensions of farmer need towards information for decision making at various stages. Fine-tuned structured questionnaire was developed to collect the responses from farmers of different villages coming to APMC markets. Here personal interview, both schedule and survey method were used to gather the data. The respondents were given a list of statements that measured their extent of agreement towards the variables. The items were measured on a 5 point Likert scale with 1 representing low score (Strongly dis agree) and 5 representing a high score (strongly agree). These statements were selected after four rounds of pilot testing with the factor loadings above 0.70. For the reliability of the research tool *Cronbach's Alpha test* was performed, and obtained the alpha value of 0.90, this shows the tool is reliable and the factors obtained based on these items are reliable, and can be used for further analysis. Also different dimensions of Information from Farmer's point of view were identified using *Factor Analysis* technique.

3. Objectives: The objectives of this paper are as follows

1. To identify the dimensions of information in agribusiness supply chain management of dry Chilli
2. To identify the factors of Information influencing the supply chain performance & efficiency

4. Need of the study

Information plays a vital role in any decision making. As farmers need information at various stages like, cultivation, harvesting, crop disease, market selection, transportation, storage, identifying commission agent, etc., therefore it is necessary to know the different dimensions of information sought by the farmers to reduce the risk and optimize the decision making strategy.

5. Data Analysis and interpretation

5.1 Reliability

The general reliability measurement is most frequently used for examining the internal consistency of the questionnaire. The consistency and stability of measurement results are Cronbach's α coefficient. The higher the Cronbach's α coefficient is, the higher will be consistency of variables to be measured, existing between each question item, this indicate the high reliability of question items in questionnaire.

Table 1: Case Processing Summary

		N	%
Cases	Valid	596	100.0
	Excluded ^a	0	0.0
	Total	596	100.0

a. List wise deletion based on all variables in the procedure.

Table 2: Reliability Statistics

Cronbach's Alpha	N of Items
.90	37

Churchill G. A. (1979) suggests eliminating question item with correlation coefficient of total single item under 0.50 for improving Cronbach's α coefficient and ensuring the reliability quality of question item. Nevertheless, Cronbach's α coefficient higher than 0.70 is adopted by this study as standard for reliability analysis of questionnaire scale.

The overall reliability achieved was 0.90. The 37 items provided in the questionnaire has consistency and reliability within acceptable range. The Cronbach's α according to Guilford (1965) is supposed to be higher than 0.70, the coefficient between 0.35 to 0.70 is acceptable, but the value under 0.35 should be dropped.

5.2 Factor Analysis

The factor analysis carried out by this study was focusing on identifying the hidden dimensions of information from the farmer's point of view, for making efficient decisions. Several views of information of farmer were taken to identify the hidden dimensions. The factors obtained through major component analysis, for extracting factor with eigenvalue over 1 as standard, then selected appropriate numbers in accordance with the requirement of the study, followed by orthogonal rotation with the maximum variation, in order to make structure of each factor to be more explicit.

5.2.1 Empirical Analysis and Interpretation

The factor analysis was carried out for the items: KMO and Bartlett's test, Communalities, Total variance explained and Factors developed matrix table based on Rotated component matrix, are obtained as a result of factor analysis. The details of the analysis are presented below.

5.2.2 KMO and Bartlett’s Test

KMO & Bartlett’s Test of Sphericity is a measure of sampling adequacy that is recommended to check the case to variable ratio for the analysis being conducted. In most academic and business studies, KMO & Bartlett’s test play an important role for accepting the sample adequacy. The suitability of data can be checked from this test.

This table shows two tests that indicate the suitability of the data. The *Kaiser-Meyer-Olkin Measure of Sampling Adequacy* is a statistic that indicates the proportion of variance in your variables that might be caused by underlying factors. Kaiser (1974) recommends accepting

values greater than 0.5 as acceptable. High values (close to 1.0) generally indicate that a factor analysis may be useful with collected data. *Bartlett’s test of sphericity* measure tests the null hypothesis that the original correlation matrix is an identity matrix. For factor analysis to work we need some relationships between variables and if the R-matrix were an identity matrix then all correlation coefficients would be zero. Therefore, we want this test to be *significant* (i.e. having a significant value less than 0.05). A significant test tells us that the R-matrix is not an identity matrix; therefore, there are some relationships between the variables we hope to include in the analysis.

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.82
Bartlett's Test of Sphericity	Approx. Chi-Square	6561.233
	df	406
	Sig.	0

Factor analysis was used in an objective to find the factorability of items using the Kaiser criterion with Eigen value as 1. Kaise- Meyer-Olkin measure of sampling adequacy was .820 which is above the recommended value of 0.5, and Bartlett’s test of sphericity was significant ($\chi^2 = 6561.233, p < .05$). The results from both the test showed the presence of sample adequacy and relation among the selected variables respectively.

Principal component analysis works on the initial assumption that all variance is common; therefore, before extracted communalities are all 1. Communalities are in terms of the proportion of variance explained by the underlying factors. After extraction some of the factors are discarded and some information is lost. So, the amount of variance in each variable that can be explained by the retained factors is represented by the communalities after extraction.

5.2.3 Communalities

Communalities tells us how much of the variance in each of the original variables is explained by the extracted factors.

Table 4: Communalities (Information driver)

	Initial	Extraction
While selecting cold storage, the information available in the market plays a vital role.	1.000	.582
I prefer to take solution from Horticulture department for crop diseases.	1.000	.683
I prefer to take solution from senior farmers for crop diseases.	1.000	.656
I prefer to take solution from peer group for crop diseases.	1.000	.667
I use my own experience for the solution of crop diseases.	1.000	.617
I use mobile toll free numbers of Kisan Call centers to get the market information.	1.000	.719
I take market information over phones.	1.000	.563
I take market information from Television programmes (like Krishimithra, Annadatha etc.,).	1.000	.496
I use to attend Krishi Mela’s for gathering information.	1.000	.504
I gather information about weather conditions from Radio.	1.000	.564
I gather information about weather conditions from Newspaper.	1.000	.515
I gather information about weather condition from mobile phone.	1.000	.472
I seek market information on arrival of dry chilli daily.	1.000	.637
I seek market information on arrival of dry chilli weekly.	1.000	.584
I seek market information on arrival of dry chilli fortnightly.	1.000	.719
I seek market information on arrival of dry chilli monthly.	1.000	.622
I seek market information on price of dry chilli weekly.	1.000	.634
I seek market information on price of dry chilli fortnightly.	1.000	.676
I seek market information on price of dry chilli monthly.	1.000	.658
I keep tracking of other markets dry chilli arrivals information, to sell at high price.	1.000	.587
I keep tracking of other markets dry chilli price information, to sell at high price.	1.000	.607
I gather market information from commission agents.	1.000	.538
While grading dry chilli, I take the information from farmer friends	1.000	.502
I am aware of government agriculture budget policies.	1.000	.617
I always attend the Agriculture training programmes conducted by Horticulture department.	1.000	.651
Horticulture department officers communicate in advance about the variation in weather conditions and precaution measures to control the loss of dry chilli crop.	1.000	.595
Horticulture dept. officer conduct training programmes about disease control measures and good cultivation practices.	1.000	.696
I am satisfied with the government institute support for sharing information of market arrivals of dry chilli.	1.000	.626
I am satisfied with the government institute support for sharing information on market price through website ‘Krishi Marata Vahini’.	1.000	.558
Extraction Method: Principal Component Analysis.		

5.2.4 Factor Extraction

Output lists the eigenvalues associated with each linear component (factor) before extraction, after extraction, and after rotation. The eigenvalues associated with each factor represent the variance explained by that particular linear component and also displays in terms of % of variance explained. It should be clear that the first few factors explain relatively large amounts of variance (especially factor 1) whereas subsequent factors explain only small amounts of variance. SPSS then extracts all factors with eigenvalues greater than 1.

The Eigen values associated with these factors are again displayed in the columns labelled *Extraction Sums of*

Squared Loadings. The values in this part are same as the values before extraction, except that the values for the discarded factors are ignored (hence, the table is blank after the third factor). In the final part of the table *Rotation Sums of Squared Loadings*, the eigenvalues of the factors after rotation are displayed. Rotation has the effect of optimizing the factor structure and one consequence for these data is that the relative importance of the three factors is equalized. Before rotation factor 1 accounted for considerably more variance than the remaining two (25.764% compared to 19.074 and 15.158), however after extraction it accounts for only 20.84% of variance (compared to 20.584 and 18.573).

Table 5: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.572	22.661	22.661	6.572	22.661	22.661	4.106	14.160	14.160
2	3.225	11.120	33.781	3.225	11.120	33.781	3.544	12.219	26.379
3	2.154	7.427	41.208	2.154	7.427	41.208	2.229	7.685	34.063
4	1.710	5.898	47.105	1.710	5.898	47.105	2.205	7.605	41.668
5	1.404	4.840	51.945	1.404	4.840	51.945	1.943	6.701	48.370
6	1.351	4.658	56.603	1.351	4.658	56.603	1.831	6.314	54.684
7	1.128	3.889	60.493	1.128	3.889	60.493	1.685	5.809	60.493
8	.964	3.325	63.818						
9	.904	3.117	66.934						
10	.852	2.939	69.873						
11	.755	2.604	72.477						
12	.682	2.350	74.827						
13	.659	2.272	77.100						
14	.647	2.230	79.329						
15	.603	2.078	81.407						
16	.574	1.979	83.386						
17	.534	1.842	85.228						
18	.520	1.792	87.019						
19	.477	1.646	88.665						
20	.458	1.581	90.246						
21	.421	1.450	91.697						
22	.392	1.352	93.049						
23	.382	1.318	94.367						
24	.335	1.157	95.524						
25	.309	1.066	96.590						
26	.284	.980	97.570						
27	.274	.945	98.515						
28	.239	.823	99.337						
29	.192	.663	100.000						

Extraction Method: Principal Component Analysis.

5.2.5 Rotated component Matrix

The rotated component matrix (also called as rotated factor matrix in factor analysis) which is a matrix of the factor loading for each variables onto each factor. This matrix contains the same information as the component matrix

except that it is calculated after rotation. Before rotation, most variables loaded highly onto the first factor and the remaining factors didn't really get a look in. however rotation of the factor structure has clarified things considerably.

Table 6: Rotated Component Matrix

	Rotated Component Matrix ^a						
	Component						
	1	2	3	4	5	6	7
Horticulture dept. officer conduct training programmes about disease control measures and good cultivation practices.	0.803	0.164	-0.04	-0.012	0.045	0.139	0.038
I am satisfied with the government institute support for sharing information of market arrivals of dry chili.	0.741	0.006	0.17	0.075	-0.021	0.177	-0.1
I am aware of government agriculture budget policies.	0.707	0.214	0.215	-0.042	-0.058	0.08	0.117
I always attend the Agriculture training programmes conducted by Horticulture department.	0.686	0.353	-0.038	-0.068	0.015	0.108	0.197

Horticulture department officers communicate in advance about the variation in weather conditions and precaution measures to control the loss of dry chili crop.	0.686	0.296	0.016	-0.119	0.047	0.142	0.03
I am satisfied with the government institute support for sharing information on market price through website 'Krishi Marata Vahini'.	0.671	-0.037	-0.15	0.142	0.173	0.164	0.083
I gather information about weather condition from mobile phone.	0.591	0.043	0.299	0.015	0.103	0.002	0.144
I seek market information on arrival of dry chili fortnightly.	0.04	0.789	-0.032	0.064	0.279	-0.023	0.102
I seek market information on price of dry chili fortnightly.	0.127	0.756	-0.123	0.027	0.04	0.25	0.087
I seek market information on price of dry chili monthly.	0.122	0.706	0.293	-0.026	-0.048	0.183	0.147
I seek market information on arrival of dry chili monthly.	0.196	0.66	0.254	-0.146	-0.002	0.247	-0.023
I seek market information on price of dry chili weekly.	0.364	0.645	0.046	0.118	-0.155	0.052	-0.207
I seek market information on arrival of dry chili weekly.	0.173	0.613	0.106	0.2	0.199	-0.292	-0.05
While grading dry chili, I take the information from farmer friends	0.049	0.002	0.685	0.135	0.106	-0.027	-0.013
I keep tracking of other markets dry chili arrivals information, to sell at high price.	0.135	0.179	0.654	0.301	-0.105	0.078	-0.03
I take market information from Television programmes (like Krishimithra, Annadatha etc.,).	0.157	0.098	0.482	0.123	0.421	-0.067	0.181
I use to attend Krishi Mela's for gathering information.	-0.028	0.076	0.438	0.066	0.351	-0.031	0.421
I prefer to take solution from peer group for crop diseases.	-0.105	-0.038	0.184	0.76	0.115	0.163	0.05
I use my own experience for the solution of crop diseases.	0.149	0.07	-0.137	0.648	0.264	-0.166	0.231
I gather market information from commission agents.	-0.104	0.004	0.284	0.632	0.125	0.089	0.155
I keep tracking of other markets dry chili price information, to sell at high price.	0.084	0.161	0.421	0.617	-0.084	0.092	-0.025
I seek market information on arrival of dry chili daily.	0.176	0.12	-0.129	0.19	0.709	-0.093	-0.166
I gather information about weather conditions from Radio.	-0.058	0.015	0.112	0.062	0.704	0.144	0.166
I gather information about weather conditions from Newspaper.	0.094	0.068	0.438	0.061	0.551	0.033	0.032
I prefer to take solution from Horticulture department for crop diseases.	0.245	0.343	-0.016	0.034	-0.031	0.689	0.166
I prefer to take solution from senior farmers for crop diseases.	0.255	-0.027	0.058	0.279	0.036	0.679	-0.217
While selecting cold storage, the information available in the market plays a vital role.	0.351	0.172	-0.005	-0.016	0.08	0.647	0.057
I use mobile toll free numbers of Kisan Call centers to get the market information.	0.182	0.258	0.031	0.069	-0.042	0.04	0.781
I take market information over phones.	0.134	-0.147	0.016	0.209	0.091	-0.007	0.686
Extraction Method: Principal Component Analysis.							
Rotation Method: Varimax with Kaiser Normalization.							

Factor analysis for the construct Information extracted seven factors.

The first Factor had seven items "Horticulture dept. officer conduct training programmes about disease control measures and good cultivation practices, I am satisfied with the government institute support for sharing information of market arrivals of dry chili, I am aware of government agriculture budget policies, I always attend the Agriculture training programmes conducted by Horticulture department, Horticulture department officers communicate in advance about the variation in weather conditions and precaution measures to control the loss of dry chili crop, I am satisfied with the government institute support for sharing information on market price through website 'Krishi Marata Vahini' and I gather information about weather condition from mobile phone" with factor loadings as 0.803, 0.741, 0.707, 0.686, 0.686, 0.671 and 0.591. This factor was represented as "Government Initiatives & Role of Horticulture".

Factor two had loading from items "I seek market information on arrival of dry chili fortnightly, I seek market information on price of dry chili fortnightly, I seek market information on price of dry chili monthly, I seek market information on arrival of dry chili monthly, I seek market information on price of dry chili weekly and I seek market information on arrival of dry chilli weekly", with loadings as 0.793, 0.752, 0.712, 0.663, 0.640 and 0.613. Factor2 was termed as "Frequency of Seeking market information".

The third factor had set of items as "While grading dry chili, I take the information from farmer friends, I keep tracking of other markets dry chili arrivals information, to sell at high price, I take market information from Television programmes (like Krishimithra, Annadatha etc.,) and I use to attend Krishi Mela's for gathering information", with factor loadings as 0.761, 0.687, 0.649 and 0.622. This factor is termed as "Sources of gathering market information".

Fourth Factor had set of items like "I prefer to take solution from peer group for crop diseases, I use my own experience for the solution of crop diseases, I gather market information from commission agents and I keep tracking of other markets dry chili price information, to sell at high price", The loadings of the items are 0.760, 0.648, 0.632 and 0.617 and the factor is termed as "Sources of information for crop diseases".

The fifth factor has items "I seek market information on arrival of dry chili daily, I gather information about weather conditions from Radio and I gather information about weather conditions from Newspaper", with loadings as 0.709, 0.704 and 0.551 and the factor is termed as "Sources of weather and market information".

The sixth factor has items like "I prefer to take solution from Horticulture department for crop diseases, I prefer to take solution from senior farmers for crop diseases and While selecting cold storage, the information available in the market plays a vital role" had loadings as 0.689, 0.679

and 0.647 and it is represented as “Solutions for crop diseases”.

The final factor termed as “collecting market information using phone & mobile” had loadings as 0.781 to 0.686 from items “I use mobile toll free numbers of Kisan Call centers to get the market information and I take market information over phones”.

5.2.6 Consolidated Factor Analysis

The summarized factor analysis is shown in below table. The factor loading was drawn by checking the potentiality (high loadings) from rotated component matrix, which help to identify key items showing common behavior of farmers towards development of factors, they are as shown in below table.

Table 7: Consolidated factor analysis

Factor	Factor variance explained	Loading	Variables included in the factors
Government Initiatives & Role of Horticulture	Factor explains 14.16% of variance	0.803	Horticulture dept. officer conduct training programmes about disease control measures and good cultivation practices.
		0.741	I am satisfied with the government institute support for sharing information of market arrivals of dry chili.
		0.707	I am aware of government agriculture budget policies.
		0.686	I always attend the Agriculture training programmes conducted by Horticulture department.
		0.686	Horticulture department officers communicate in advance about the variation in weather conditions and precaution measures to control the loss of dry chili crop.
		0.671	I am satisfied with the government institute support for sharing information on market price through website ‘Krishi Marata Vahini’.
		0.591	I gather information about weather condition from mobile phone.
Frequency of Seeking market information”.	Factor explains 12.219% of variance	0.789	I seek market information on arrival of dry chili fortnightly.
		0.756	I seek market information on price of dry chili fortnightly.
		0.706	I seek market information on price of dry chili monthly.
		0.66	I seek market information on arrival of dry chili monthly.
		0.645	I seek market information on price of dry chili weekly.
		0.613	I seek market information on arrival of dry chili weekly.
		0.685	While grading dry chili, I take the information from farmer friends
“Sources of gathering market information	This factor explains 7.685% of variance	0.654	I keep tracking of other markets dry chili arrivals information, to sell at high price.
		0.482	I take market information from Television programmes (like Krishimithra, Annadatha etc).
		0.438	I use to attend Krishi Mela’s for gathering information.
		0.76	I prefer to take solution from peer group for crop diseases.
Sources of information for crop diseases”.	This factor explains 7.605% of variance	0.648	I use my own experience for the solution of crop diseases.
		0.632	I gather market information from commission agents.
		0.617	I keep tracking of other markets dry chili price information, to sell at high price.
		0.709	I seek market information on arrival of dry chilli daily.
Sources of weather and market information”.	This factor explains 6.701% of variance	0.704	I gather information about weather conditions from Radio.
		0.551	I gather information about weather conditions from Newspaper.
		0.689	I prefer to take solution from Horticulture department for crop diseases.
Solutions for crop diseases”.	This factor explains 6.314% of variance	0.679	I prefer to take solution from senior farmers for crop diseases.
		0.647	While selecting cold storage, the information available in the market plays a vital role.
		0.781	I use mobile toll free numbers of Kisan Call centers to get the market information.
“collecting market information using phone & mobile”	This factor explains 5.809 % of variance	0.686	I take market information over phones.

The most liked marketing elements by retailers are located with the help of factor analysis; The questions loaded highly (>0.7) on each factor shows common interest for which we need to give new name. Hence, seven factors are obtained from factor analysis, which explains the behavior of farmers towards the need of information for decision making.

6. Findings

Horticulture department officers conduct training programmes about disease control measures and good cultivation practices. Farmers always attend these agriculture training programmes. Farmers not only are dependent on training programs, but also on the advance communication from Horticulture department officers about the variation in weather conditions and precaution measures to control the loss of dry chili crop.

Farmers are satisfied with the government institute support for sharing information of market arrivals of dry chili and sharing information on market price through website ‘Krishi Marata Vahini’. Also they are aware of government agriculture budget policies.

Farmers gather information about weather condition from mobile phone, Radio and News paper. Farmers take market information from Television programmes (like Krishimithra, Annadatha etc.), Krishi Mela’s, commission agents and over phones from Kisan Call centers.

Farmers seek information on arrival and price of dry chilli daily, weekly, fortnightly and monthly. They also track other market information about dry chili arrivals and price to sell at a high price.

Farmers take information from Horticulture department, friends and senior farmers about crop disease and grading

dry chili. While selecting cold storage, the information available in the market plays a vital role.

7. Conclusions

It can be concluded from the research that farmers are interested in the Government initiatives and role of horticulture department. They seek information about weather conditions, crop diseases, profitable market and cold storage frequently. Farmers prefer information from various sources like land phones and mobile phones to sell dry chilli at high prices.

As the initiatives from Government and Horticulture department are reaching the needy, further focusing on the dimensions of information as identified in the research, can enhance the performance and efficiency in the dry chilli supply chain.

8. Scope for Further Research

There are many drivers influencing agriculture supply chain management like facilities, transportation, sourcing, pricing, inventory and external factors. Further research can be carried out to identify the influence of these drivers on the agriculture supply chain management to understand the agility in the supply chain.

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