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DIMENSIONS OF DRY CHILLY INVENTORY MANAGEMENT BY FARMERS

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ABSTRACT
Inventory management is extremely important from a farmers perspective, as it enables them to address various important issues like fluctuation in demand over a period of time. To avoid loss, farmers maintain quality of dry chilly by storing it in cold storage and wait for the right time to sell at a profitable time. Therefore maintaining inventory in such a form which helps him to access market quickly, profitably with quality is a challenge. Therefore this research brings out the farmers knowledge of loss and reasons for the choice of cold storage, grading, drying and packing dry chilly inventory. Exploratory factor analysis is being used in this research to understand the drily inventory management by farmers.

INTRODUCTION
India is a country of geographic diversities- varied soil-types, habitats, climates and vegetation, India is a major producer of food (fruits, vegetables, wheat, pulse, milk, spices, etc.) in the world after China (Anju Bharti, 2014). Supply chain management has generated a substantial amount of interest both by managers and researchers. Supply chain management is now seen as a governing element in strategy and as an effective way of creating value for customers. There are many concepts and strategies are applied in designing and managing supply cahains (Simchi-Levi et.al. 1999). The expanding importance of supply chain integration presents a challenge to research to focus more attention on supply chain modeling (Tayur et al., 1999). According to Axsa¨ter (1985), "the purpose of a production/inventory control system (the method used to control inventory levels and production rates) is to transform incomplete information about the market place into co-ordinated plans for production and replenishment of raw materials". Maintaining quality and controlling weight loss of dry chilly at different places of facilities (field, farm gate, farmers storing place, commission agents godown, cold storage) and during transportation is a challenging task for any farmer, to enhance his profit even though making a strategic decision either to keep inventory in cold storage, or sell dry chilly in the market at available price is a critical bottleneck decision faced by the farmer.

LITERATURE REVIEW
Supply chain management
Supply chain management has become an increasingly important topic to agribusiness managers during the past five years (Dr. Frank et. Al., 1998). Supply Chain Management as a business strategy can combine both microeconomic and macroeconomic aspects of preferred value chains (M. Mau, 2002)

Supply chains are complex entities that serve many functions. They are institutional arrangements that link producers, processors, marketers and distributors. Supply chains are forms of industrial organization which allow buyers and sellers who are separated by time and space to progressively add and accumulate value as products pass form one member of the chain to the next (Hughes, 1994, Fearne, 1996, Hadfield and Nichols, 1999). Supply chains are the conduits through which (Cooper et al., 1997):

- Products move from producers to consumers;
- Payments, credit and working capital move from consumers to producers;
- Technology and advanced techniques are disseminated among producers, packagers and processors;
- Ownership rights pass from producers to processors and ultimately to marketers;

- Information on current customer demand and on retail level product preferences pass back from retailers to producers.

A supply chain is a system consisting of material suppliers, production facilities, distribution services and customers who are all linked together via the downstream feed-forward flow of materials (deliveries) and the upstream feedback flow of information (orders), (Stevens, 1989).

The management of the supply chain aims to manage, coordinate, develop standards and benchmarks so that all work satisfactorily, seeking to reach the ideal balance between supply of raw materials, finished products and consumption. Being responsible for planning and controlling the flow of materials, which aims to maximize the use of company resources (ARNOLD, 1999). Supply chain management is defined as the alignment of objectives and the integration of resources across company boundaries in order to create value (Lorentz, 2008). With advanced information technologies, supply chains nowadays are no longer limited to geographical borders; instead, they are linked in a complex worldwide network for trading (Lemoine and Dagnæs, 2003). Genuine sustainable supply chain management is now critical to achieve competitive advantage. Risk, uncertainty, strategy, innovation, relationship, infrastructure, regulation and technology are typically historically important areas that have a strong impact on sustainable SCM (Jayaratne, P., Styger, L. & Perera, N. 2011).

Agribusiness supply chain management

Agriculture based supply networks improve the social wellbeing and reduce poverty in many developing countries (Stamm, Jost, Kreiss, Meier, Pfister, Schukat &Speck 2006). Agri-supply chains are also economic systems which distribute benefits and which apportion risks among participants. Thus, supply chains enforce internal mechanisms and develop chain wide incentives for assuring the timely performance of production and delivery commitments (Iyer & Bergen, 1997, Lambert and Cooper, 2000). Agri-supply chains are also economic systems which distribute benefits and which apportion risks among participants. Thus, supply chains enforce internal mechanisms and develop chain wide incentives for assuring the timely performance of production and delivery commitments (Iyer & Bergen, 1997, Lambert and Cooper, 2000). Managing the agri-supply chain has become overly complicated (Christien et al. 2006) because, the agri- supply chain can also be described as a value creation process, it also includes other activities such as research & development, logistics activities from farm to the consumer (Stamm et al. 2006; Ahumada & Villalobos 2009). Therefore, implementing supply chain management practices have essentially become an important element in the agricultural sector (Christien, Jo H.M. Wijnanda, Ruud B.M. Huirne &Olaf Van Kooten 2006).

Inventory

Inventory could include raw material, intermediary or in-process goods, and finished goods. Inventory management becomes crucial, and is related to a firm's strategic intent and the competitive situation in which it operates. Inventory plays a significant role not only in the supply chain but also in competitive strategies. Bachetti, Plebani, Saccani and Syntetos (2010) argue that inventory management need to be organized in a logical way to facilitate the organization knowledge of when to order and quantity to order. The lack of coordination in supply chains can cause various inefficiencies like bullwhip effect and inventory instability (Francesco Costantino , Giulio Di Gravio, Ahmed Shaban, Massimo Tronci , 2013). Inventory is also a critical asset in any organization though according to Barnes (2008) inventory is looked at as a liability under the just-in-time (JIT) control system. The inventory management has strategic importance for business success since it gives the media more diverse production systems by increasing or reducing inventories and generating factor of production and financial gains.

OBJECTIVE

The main objective of the study is to identify the different dimensions of inventory related decision making strategies of the dry chilly farmers.

NEED OF THE STUDY

Efficient management of inventory is the main part of any supply chain decisions, as the inventory of dry chilly is influenced by quality, perishability, cold storage availability and market information of arrival and price. Hence it is a big challenge for a farmer. Therefore it is necessary to understand, how a farmer maintains the quality of

dry chilly, avoids the loss of dry chilly at various aspects and takes a wise decision if, expected price is not there after bringing dry chilly to the market.

RESEARCH METHODOLOGY

In this research for the clarity of research problem exploratory and descriptive research design was used. The sample size determined was 596 farmers trading dry chilli in three APMCs of Karnataka (state), they are Hubballi, Byadagi, and Gadag. Judgmental and convenience sampling under non-probability sampling techniques were used while identifying the dry chilli farmers as respondents for the study. The secondary data for the literature was collected from APMC website, Horticulture department, and 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 *Inventory* for decision making at various stages. Here both schedule and survey method were used to gather the data using questionnaire. 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 0.778, 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 *Inventory* from Farmer's point of view were identified using *Factor Analysis* technique.

DATA ANALYSIS AND INTERPRETATION

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
0.778	17

EXPLORATORY FACTOR ANALYSIS

Factor analysis is a data reduction statistical technique that allows simplifying the correlational relationships between a numbers of continuous variables. Exploratory factor analysis is used in order to identify constructs and investigate relationships among key interval scaled questions regarding preferences given by farmers to make right decisions. The factor analysis carried out by this study was focusing on identifying the hidden dimensions of supply chain driver *Inventory* from the farmer's point of view, for making efficient decisions. Several views of Inventory 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.

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**.**

Table 3: Exploratory Factor Analysis for Inventory

(F-Inventory) KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.766
Bartlett's Test of Sphericity	Approx. Chi-Square	2963.536
	df	136
	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 .766 which is above the recommended value of 0.5, and Bartlett's test of Sphericity was significant (χ^2 = 2963.536, p<.05). The results from both the test showed the presence of sample adequacy and relation among the selected variables respectively.

Communalities, Total variance explained & Rotated Component Matrix

Communalities

Communalities explains the variance of each of the variables explained by the extracted factors. 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 in the table number 4

Total Variance Explained

The eigenvalues above 1 have generated five factors (3.87, 2.38, 2.14, 1.14, 1.07) which obtained after rotation. Rotation has the effect of optimizing the factor structure and one consequence for these data is that the relative importance of the data items generate equalized factors.

Total Variance explains the % of extraction by each factor representing common interest of items belongs to the factor. Total variance of 5 factors abstracts the % of variance explained by each factor (16.04%, 14.84%, 13.52%, 10%, 7.94%) respectively shown in the table number 4.

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 4: Rotated Component Matrix

Rotated Component Matrix[a]						
	Component					**Communalities**
	1	**2**	**3**	**4**	**5**	
I prefer to keeping inventory in cold storages on the basis of monthly term.	**0.844**	0.044	0.049	0.072	0.067	0.726

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I prefer keeping inventory in cold storages only after the condition of anytime withdrawal in a year.	**0.82**	0.128	0.042	0.043	0.036	0.694
I prefer keeping inventory in cold storages for entire year term basis.	**0.82**	0.016	0.043	-0.042	0.037	0.677
I am satisfied with the government dry chili storage facilities.	**0.725**	0.027	0.172	-0.028	0.03	0.558
I prefer to grade dry chili based on it's ring size.	0.005	**0.807**	0.047	0.147	-0.043	0.677
I prefer to grade dry chili based on redness.	0.02	**0.792**	0.004	0.162	0.045	0.656
I prefer to grade dry chili based on it's length.	0.053	**0.763**	0.069	-0.153	0.114	0.626
I prefer to grade dry chili based on it's pungency.	0.295	**0.649**	0.138	-0.404	0.069	0.695
While sorting of dry chili, wastage leads to loss.	0.101	-0.05	**0.7**	0.173	0.099	0.543
Cleaning & drying at commission agents place in market leads to loss.	0.031	0.195	**0.66**	0.351	-0.072	0.603
I will take dry chili directly to market immediately after drying.	0.02	-0.063	**0.613**	0.061	0.303	0.476
I prefer such commission agent who takes care of drying the inventory when it arrives in wet conditions.	0.134	0.066	**0.602**	-0.082	0.196	0.43
Drying of dry chili leads to Weight loss.	0.088	0.394	**0.593**	0.185	-0.224	0.599
I prefer to use high cost gunny bags as, I want to maintain quality of dry chili.	0.013	-0.003	0.093	**0.745**	0.147	0.586
I Prefer to clean dry chili before packing.	0.033	0.043	0.339	**0.697**	0.039	0.605
While grading, I use to follow market standards.	0.109	0.123	0.31	-0.024	**0.759**	0.7
I prefer to grade dry chili based on it's dryness.	0.064	0.025	0.044	0.465	**0.724**	0.748
Eigen Value *	**3.87**	**2.38**	**2.14**	**1.14**	**1.07**	
TVE *	**16.04**	**14.84**	**13.52**	**10**	**7.94**	
Extraction Method: Principal Component Analysis.						
Rotation Method: Varimax with Kaiser Normalization.						
a. Rotation converged in 7 iterations.						

Five factors were extracted from the exploratory factor analysis of the items considered for the construct Inventory. Factor1 had four items namely I prefer to keeping inventory in cold storages on the basis of monthly term, I prefer keeping inventory in cold storages only after the condition of anytime withdrawal in a year, I prefer keeping inventory in cold storages for entire year term basis and I am satisfied with the government dry chili storage facilities with factor loadings as 0.844, 0.820, 0.820 and 0.725. This factor was termed as "Choice of keeping dry chili in cold storage for different duration".

The second set of factor had four items namely I prefer to grade dry chili based on it's ring size, I prefer to grade dry chili based on redness, I prefer to grade dry chili based on it's length and I prefer to grade dry chili based on it's pungency with factor loadings as 0.807, 0.792, 0.763 and 0.649. Factor2 is represented as "Basis for grading of dry chili".

Five items namely While sorting of dry chili, wastage leads to loss, Cleaning & drying at commission agents place in market leads to loss, I will take dry chili directly to market immediately after drying, I prefer such commission

agent who takes care of drying the inventory when it arrives in wet conditions and Drying of dry chili leads to Weight loss had loadings on the factor as 0.700, 0.660, 0.613, 0.602 and 0.593. Factor3 is represented as "Drying of chili and reasons for loss".

Two items namely I prefer to use high cost gunny bags as, I want to maintain quality of dry chili and I Prefer to clean dry chili before packing with factor loadings 0.745 and 0.697 were represented as "Packing of dry chilli". The final factor represented as "Grading with market standards" had two items While grading, I use to follow market standards and I prefer to grade dry chili based on it's dryness had factor loadings as 0.759 and 0.724.

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 5: Consolidated factor analysis of driver Inventory

Factor	Factor	Loading	Variables included in the factors
Choice of keeping dry chili in cold storage for different duration	Factor explains 14.35% of variance	**0.844**	I prefer to keeping inventory in cold storages on the basis of monthly term.
		0.82	I prefer keeping inventory in cold storages only after the condition of anytime withdrawal in a year.
		0.82	I prefer keeping inventory in cold storages for entire year term basis.
		0.725	I am satisfied with the government dry chili storage facilities.
Basis for grading of dry chili	Factor explains 12.153% of variance	**0.807**	I prefer to grade dry chili based on it's ring size.
		0.792	I prefer to grade dry chili based on redness.
		0.763	I prefer to grade dry chili based on it's length.
		0.649	I prefer to grade dry chili based on it's pungency.
Drying of chili and reasons for loss	This factor explains 12.01% of variance	**0.7**	While sorting of dry chili, wastage leads to loss.
		0.66	Cleaning & drying at commission agents place in market leads to loss.
		0.613	I will take dry chili directly to market immediately after drying.
		0.602	I prefer such commission agent who takes care of drying the inventory when it arrives in wet conditions.
		0.593	Drying of dry chili leads to Weight loss.
Packing of dry chilli	This factor explains 7.763% of variance	**0.745**	I prefer to use high cost gunny bags as, I want to maintain quality of dry chili.
		0.697	I Prefer to clean dry chili before packing.
Grading with market standards	This factor explains 7.561% of variance	**0.759**	While grading, I use to follow market standards.
		0.724	I prefer to grade dry chili based on it's dryness.

The most liked inventory related elements by farmers are located with the help of factor analysis; the questions loaded range of 0.5 and above on each factor shows common interest for which we need to give new name. Hence, five factors are obtained from factor analysis, which explains the behavior of farmers towards the decision making related to Inventory.

FINDINGS

Farmer prefer to keeping inventory in cold storages on the basis of monthly, year term basis, and any-time withdrawal condition in a year. They are satisfied with the government dry chilly storage facilities.

Farmers prefer to grade dry chili based on its ring size, redness, length, and pungency. Farmers prefer to clean dry chili before packing. To maintain the quality of dry chilly they prefer high cost gunny bags. Farmers prefer to grade dry chili based on its dryness and while grading they use to follow market standards.

Farmers bring dry chili directly to market immediately after drying. Farmers feel that loss occurs in two stages i.e., while sorting of dry chili at the farm gate. And during Cleaning & drying at commission agents place in the market.

CONCLUSIONS

Efficiency of supply chain demands managing the inventory with optimized strategies of a farmer. It can be concluded from the research that farmers grade dry chilly according to market standards like ring size, redness, length and pungency before coming to market. Therefore grading the inventory and packing accordingly enables the farmer trade wisely and profitably. Farmers are aware of reasons of wastage and loss. Hence for packing of dry chilly farmers prefer to dry and store in high quality gunny bags. Farmers develop different choice of keeping dry chilly in cold storage for different duration, so that cost of storing can be controlled and minimized.

SCOPE FOR FURTHER RESEARCH

Similar research can be carried on other cross functional supply chain drivers other than inventory like pricing, information, sourcing and logistic drivers like transportation and facility.

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