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Dimensions of driver sourcing preferred by dry chilly farmers in supply chain management

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Abstract
Inputs that are involved in procurement decisions for an individual farmer include seeds, fertilizer, pesticides, plant nutrients, extension services, and labour. Though one would think that such procurement decisions are mostly driven by the fundamental economics of agrarian principles, farmer decision also play a major role. Through this research It is possible understand the farmer behaviour towards sourcing. Factor analysis was used in this research. This article brings out the reasons for the selection required agricultural sources for the production of dry chilly, commission agent, and market to sell dry chilly.

Keywords: agribusiness supply chain, dry chilly farmers, sourcing, driver, factor analysis

1. Introduction
India 'Land of spices' is the major producer and exporter of chillies. An efficient supply chain ensuring remunerative prices to the producers for their products and to deliver maximum satisfaction to the end consumers for the price they pay (Y Prabhavathi, N T Krishna Kishore, Dr. Seema, 2013) [1]. The history and culture of Indian spices is probably as old as human civilization itself. The vedas, the bible and quran are all replete with references-direct or indirect-to Indian spices. The earliest literature record in India on spices is the Rig Veda, and other three vedas Yadur, Sama and Atharva (Rohatash. K. Bhardwaj, B. K. Sikka, Ashutosh Singh, M.L. Sharma, N. K. Singh, 2011) [2]. 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 (Somashekhar *et al.*, 2016) [3].

The major producers in the world are India, China, Pakistan, Morocco, Mexico, Turkey and Bangladesh. Chillies are grown in all regions of India. The major Producers are Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu, Orissa and Rajasthan contributing 2/3rd of India's production. And Andhra Pradesh alone contributes 46% for production making it the largest producer in India. Andhra Pradesh has a production of 5.58 lakh MT area from 1.74 lakh hectares, which accounts for 26 % percent of area and 54 % percent of production in the country. In Andhra Pradesh it is grown in all the districts namely Warangal, Khammam, Guntur, Karimnagar, Prakasham and some other districts. (Y Prabhavathi, N T Krishna Kishore, Dr. Seema, 2013) [1].

Sourcing has a key role in supply chain, and would be considered as one of the drivers in many businesses, especially in agribusiness systems. Sourcing refers to a number of strategic activities that go into supplier relationship management (N. Chandrasekaran & G. Raghuram, 2014) [4]. Sourcing of requirements to grow dry chilli impacts the quality and yield of crop to the farmers, Hence farmers selection and identification of seeds, fertilizers, labours, packing materials and transportation affects the production.

2. Literature Review
2.1 Dry Chilly
Chillies are pungent fruits of capsicum annum L and capsicum frutescence (Y Prabhavathi, N T Krishna Kishore, Dr. Seema, 2013) [1]. Chilly is one of the most important commercial crops of India. It is an indispensable item in the kitchen as it is being consumed daily as a condiment in one form or the other. Among the spices consumed per head, dried chilly fruits constitute a major share (B. C. Rajur, B. L. Patil and H. Basavaraj, 2008) [5].

Chilly is one of the important vegetable spices grown all over the world except in colder parts. It is also known as red pepper or hot pepper and it constitutes an important well-known commercial crop used as a condiment, culinary supplement or as a vegetable. Chilly is mainly used as culinary supplement to add flavour, colour, vitamin and pungency. Chilly is virtually an indispensable item in the kitchen. Different varieties are grown for vegetables, spices, condiments, sauces and pickles (K Gurava Reddy, A Subbarami Reddy, J. Satish babu, and M Chandra Sekhara Reddy, 2011) [6]. Chilly is an important spice crop as well as vegetable crop grown all over India (Y Prabhavathi, N T Krishna Kishore, Dr. Seema,2013) [1].

2.2 Supply chain Management
Supply chain management and other similar terms, such as network sourcing, supply pipeline management, value chain management, and value stream management have become subjects of increasing interest in recent years, to academics, consultants and business management (Christopher, 1992; Hines, 1995; Lamming, 1996; Saunders, 1995, 1998) [7, 8, 9,10,11]. It is recognised in some parts of the literature that the supply chain should be seen as the central unit of competitive analysis (Macbeth and Ferguson, 1992; Cox, 1997) [12]. Supply chain management has received attention since the early 1980s, yet

conceptually the management of supply chains is not particularly well-understood, and many authors have highlighted the necessity of clear definitional constructs and conceptual frameworks on supply chain management (Saunders, 1995, 1998; New, 1995; Cooper *et al.,* 1997; Babbar and Prasad, 1998) [10, 11, 13, 14, 15].

Saunders (1995) [10] warns that pursuit of a universal definition, the term supply chain management has not been used only with regard to the logistics activities and the planning and control of materials and information flows internally within a company or externally between companies. Some authors have used it to describe strategic, inter-organisation issues (Cox, 1997) [16], others to discuss an alternative organisational form to vertical integration (Thorelli, 1986) [17], others to identify and describe the relationship a company develops with its suppliers (Sako, 1992; Lamming, 1993; Hines, 1994) [8]. Companies will not seek to achieve cost reductions or profit improvement at the expense of their supply chain partners, but rather seek to make the supply chain as a whole more competitive. In short, the contention that it is supply chains, and no single firms, that compete is a central tenet in the field of supply chain management (Christopher, 1992; Macbeth and Ferguson, 1994) [17]. Supply Chain as a sequence of (decision making and execution) processes and (material, information and money) flows that aim to meet final customer requirements, that take place within and between different stages along a continuum, from production to final consumption. The Supply Chain not only includes the producer and its suppliers, but also, depending on the logistic flows, transporters, warehouses, retailers, and consumers themselves. In a broader sense, supply chains include also new product development, marketing, operations, distribution, finance and customer service (J. Jayasudha, dr. S. Swamidoss, 2012) [18].

A supply chain is defined as "the integration of key business processes from end users through original suppliers that provides products, services, and information that adds value for customers and other stakeholders" (Lambert *et al.,* 1998) [19]. Modern supply chains are expected to respond rapidly, effectively and efficiently to changes in the marketplace (Denis R. Towill, 1996) [20]. Effective supply chain practices are expected to result in improved supply chain performance (Narasimhan and Kim, 2002) [21]. In today's international business dynamic, globally competitive environment supply chain management is a critical strategic initiative (Jung Sik Jeong and Paul Hong, 2007) [22].

2.3 Agri supply chain management

In the last two decades, deregulation has opened many agribusiness markets around the world (Thompson, 2001; Woods, 2004; Hanf and Pall, 2009) [23, 24, 25]. Commercial interest in supply chain management (SCM) in agribusiness is increasing in India due to greater urbanization, changes in consumer lifestyles, and increased competition among producer cooperatives, traders, and newly formed food and agricultural commodity business companies, which are now becoming involved in procurement and distribution channel management (Eisenhardt, 1989; Cooper *et al.,* 1997; Thompson, 2001; Woods, 2004) [26, 14, 23, 24].

Supply chain management in agribusiness implies managing the relationships between the businesses responsible for the efficient production and supply of agricultural products from the farm gate to consumers with the broad objective of meeting consumers' requirements in terms of quantity, quality, and price (Jaffee, 1994; Lambert and Cooper, 2000; Handfield and Nichols, 1999; ITC Ltd., 2007) [27, 28, 29, 30].

Lowe and Preckel (1968) characterize the agri-food supply chain as the ones with the long lead times and misalignment and uncertainty between their demand and supply. SCM provides an integrated approach to plan the improvements required in the management of their agricultural production and marketing systems to meet future challenges (UNCTAD, 2004; Woods, 2004) [24].

Supply Chain Management focuses on improving the performance of the supply chain through the delivery of guaranteed safe, desirable and good quality food in a less cost with effective manner. The increasing transaction costs for intensive agriculture and the need to reduce these costs lie at the heart of interest in agricultural supply chain management. A supply chain in agriculture can be thought of as a " farm to fork " process – from the inputs to production to processing, marketing and the consumer (Sachin Ghai, 2012) [31]. Agribusiness is defined as practice of activities relating to production, processing, marketing, distribution and trade of food, feed and fibre (Acharya, 2006) [32]

The Agriculture is a complex system that operates a large number of players. The objective of supply chain in agriculture practice was imposed under the pressure of having to best meet the customer at lower cost. (F. Lestari *et al*., 2013) [33].

Success of Supply Chain in Agriculture is affected by food quality, food safety, and weather related variability. Therefore, Agriculture Supply Chain products which are perishable faced problems of short product lifetime making it even more complex. The entire of agriculture processes are began at harvesting in plantation, processed industry, storage and distribute to customer (F. Lestari *et al*., 2013) [33].

2.4 Sourcing

Sourcing is also referred to as the Procurement and purchasing of goods and services for commercial purposes. Every decision unit, be it a farmer or a firm, sets procurement policies that govern its choice of suppliers, products, and the methods and procedures of buying. Depending upon the size of the decision making unit, and the complexity and level of formality of the agribusiness concern, procurement practices are evolved in various segments (N.Chandra Sekharan & Raghuram, 2014) [34]. At the *farm level,* sourcing decisions too many inputs and services are decided by push factors, which is based on the availability of input to be sourced off the shelf. However, mismatch between what is required at the field and when may not be available (N.Chandra Sekharan & Raghuram, 2014) [34]. However, in agriculture, factors such as seasonality and perishability adversely influence sourcing strategies for cost advantage. Because production is lumped, sourcing also needs to be managed when output reaches markets, as farmers in India do not have holding size power. Cost effectiveness in sourcing is determined by negotiating power, size and so on. Nevertheless, cost leadership can be achieved if appropriate procurement policies are in place (N. Chandrasekaran & G. Raghuram, 2014) [34]. An individual farmer, inputs that are involved in procurement decisions include seeds, fertilizer, pesticides, plant nutrients, extension services, and labour.

3. Objective

The main objective of the study is to identify different

dimensions of the sourcing related decision making strategies of the dry chilly farmer

4. Need of the Study

In the dry chilly supply chain, sourcing becomes an important activity, as it is the set of business processes required to purchase goods like seeds, fertilizers, pesticides and labor. services to grow chilly for the ultimate customers that is village merchants and commission agents. Growing quality dry chilly, and maintaining quality and weight throughout the process and choosing an appropriate time, right market and commission agent and selecting a good relationship with them is a challenge. Hence it is necessary to study the sourcing challenges of the farmers for a smoother supply chain management process.

5. 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 *Sourcing* 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 0.815, 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 *Sourcing* from Farmer's point of view were identified using *Factor Analysis* technique.

6. Data Analysis and interpretation

6.1 Reliability

Reliability was assessed using reliability coefficient Cronbach alpha. Cronbach alpha assesses the consistency of the entire scale. In exploratory studies, the suggested Cronbach alpha is a minimum of 0.60 (Kaizer, 1974, Hair *et al.*, 2012) [35, 36]. The data analysis for reliability test resulted in Cronbach alpha was 0.815 indicating significant reliability of measures.

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
0.815	20

6.2. 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 *sourcing* from the farmer's point of view, for making efficient decisions. Several views of *sourcing* 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.

6.2.1. 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**.**

Table 3: Exploratory Factor Analysis for Sourcing

(F-Sourcing) KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.775
Bartlett's Test of Sphericity	Approx. Chi-Square	2632.525
	df	136
	Sig.	0.0000

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. 775 which is above the recommended value of 0.5, and Bartlett's test of Sphericity was significant ($\chi^2 = 2632.525$, $p<.05$). The results from both the test showed the presence of sample adequacy and relation among the selected variables respectively.

6.2.2. 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 following table.

Total Variance Explained

The eigenvalues above 1 have generated five factors (3.97, 2.15, 1.83, 1.22, 1.00) 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 (14.02%, 13.42%, 13.2%, 9.69%, 9.49%) respectively.

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

(F-sourcing) Rotated Component Matrix[a]						
	Component					Communalities
	1	2	3	4	5	
I prefer to buy fertilizers from govt. departments because it provides good quality of fertilizers.	0.85	0.153	0.08	0.075	0.129	0.775
I prefer to buy fertilizers from govt. departments because it provides required quantity of fertilizers.	0.84	-0.014	0.12	0.107	0.089	0.739
I prefer to purchase fertilizers from govt. department depot only, as they offer fertilizers at lower prices	0.811	0.153	-0.063	0.096	0.105	0.706
I would like to select commission agent based on his number of years of business experience.	0.015	0.8	0.13	0.069	0.083	0.669
I select particular Commission Agent based on his good image in the market.	0.008	0.793	0.146	0.059	0.097	0.663
Due to the harvesting of other crops, getting labor for dry chili harvesting is difficult.	0.209	0.652	-0.029	0.065	0.203	0.516
I prefer such a commission agent, who arranges good number of purchasers at good price.	0.111	0.594	-0.128	0.297	-0.007	0.47
If I am not interested to visit market, commission agent make personal visit to farm and offer good market price.	-0.067	0.118	0.779	0.104	0.096	0.646
As I am new to a particular APMC market, I prefer any commission agent blindly.	-0.024	0.05	0.7	-0.115	0.054	0.51
I prefer to use scientific methods, given by Horticulture department for cultivation of dry chili.	0.342	0.066	0.662	0.017	-0.034	0.56
I prefer to sell to village merchant instead of Commission Agent.	0.025	-0.128	0.601	0.188	0.284	0.494
I decide well in advance which commission agent to visit to sell dry chili.	0.124	0.266	0.004	0.719	-0.045	0.605
I choose a right commission agent with the help of other farmer friends.	0.197	0.025	-0.029	0.689	0.073	0.521
I prefer to a particular commission agent because he makes the payment on the same day of sales.	-0.134	0.123	0.291	0.576	0.274	0.525
Due to presence of E-tendering system at APMC, I find no harm in choosing any Commission Agent.	0.133	0.177	0.097	0.03	0.726	0.587
Commission Agent makes advance payment to Hamaals (labor) on behalf of me.	0.122	0.025	0.412	-0.065	0.664	0.63
I take my produce to such market where purchaser's participation is high.	0.112	0.177	-0.042	0.362	0.612	0.551
Eigen Value	3.97	2.15	1.83	1.22	1.0	
TVE	14.02	13.42	13.2	9.69	9.49	
Extraction Method: Principal Component Analysis.						
Rotation Method: Varimax with Kaiser Normalization.						

Through Factor analysis it was found that, Factor1 had got three items namely I prefer to buy fertilizers from govt. departments because it provides good quality of fertilizers, I prefer to buy fertilizers from govt. departments because it provides required quantity of fertilizers and I prefer to purchase fertilizers from govt. department depot only, as they offer fertilizers at lower prices with loading as 0.850, 0.840 and 0.811. This factor is represented as "Reasons for purchasing fertilizers from Government department".

Four items I would like to select commission agent based on his number of years of business experience, I select particular Commission Agent based on his good image in the market,

Due to the harvesting of other crops, getting labor for dry chili harvesting is difficult and I prefer such a commission agent, who arranges good number of purchasers at good price with loadings on the factor as 0.800, 0.793, 0.652 and 0.594 was represented as "Reason for selection of Commission Agent".
The third factor represented as "Choices for farmers while preferring Commission Agent based on perceived risk" had four items like If I am not interested to visit market, commission agent make personal visit to farm and offer good market price, As I am new to a particular APMC market, I prefer any commission agent blindly, I prefer to use scientific methods, given by Horticulture department for cultivation of dry chili and I prefer to sell to village merchant instead of Commission Agent had factor loadings as 0.779, 0.700, 0.662 and 0.601.
Three items had loadings as 0.791, 0.689 and 0.576 on Factor4 represented as "Selection of required commission agent".
The final factor in sourcing had three items Due to presence of E-tendering system at APMC, I find no harm in choosing any Commission Agent, Commission Agent makes advance payment to Hamaals (labor) on behalf of me and I take my produce to such market where purchaser's participation is high with loadings as 0.726, 0.664 and 0.612. This factor is represented as "Choosing market and commission agent"

6.2.3 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 sourcing

Factor	Factor variance explained	Loading	Variables included in the factors
Reasons for purchasing fertilizers from Government department	Factor explains 14.02% of variance	0.85	I prefer to buy fertilizers from govt. departments because it provides good quality of fertilizers.
		0.84	I prefer to buy fertilizers from govt. departments because it provides required quantity of fertilizers.
		0.811	I prefer to purchase fertilizers from govt. department depot only, as they offer fertilizers at lower prices
Reason for selection of Commission Agent	Factor explains 13.42% of variance	0.8	I would like to select commission agent based on his number of years of business experience.
		0.793	I select particular Commission Agent based on his good image in the market.
		0.652	Due to the harvesting of other crops, getting labor for dry chili harvesting is difficult.
		0.594	I prefer such a commission agent, who arranges good number of purchasers at good price.
Choices for farmers while preferring Commission Agent based on perceived risk	This factor explains 13.2% of variance	0.779	If I am not interested to visit market, commission agent make personal visit to farm and offer good market price.
		0.7	As I am new to a particular APMC market, I prefer any commission agent blindly.
		0.662	I prefer to use scientific methods, given by Horticulture department for cultivation of dry chili.
		0.601	I prefer to sell to village merchant instead of Commission Agent.
Selection of required commission agent	This factor explains 9.69% of variance	0.719	I decide well in advance which commission agent to visit to sell dry chili.
		0.689	I choose a right commission agent with the help of other farmer friends.
		0.576	I prefer to a particular commission agent because he makes the payment on the same day of sales.
Choosing market and commission agent	This factor explains 9.49% of variance	0.726	Due to presence of E-tendering system at APMC, I find no harm in choosing any Commission Agent.
		0.664	Commission Agent makes advance payment to Hamaals (labor) on behalf of me.
		0.612	I take my produce to such market where purchaser's participation is high.

The most liked marketing elements by retailers 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, four factors are obtained from factor analysis, which explains the behaviour of farmers towards the decision making related to sourcing.

7. Findings

Farmers prefer to buy fertilizers from govt. departments because it provides good quality of fertilizers, in required quantity at lowest prices. Farmers know that due to the harvesting of other crops, getting labor for dry chili harvesting is difficult. Farmers prefer to use scientific methods, given by Horticulture department for cultivation of dry chili.
I would like to select commission agent based on his number of years of business experience, good image in the market, and his capacity to arrange good number of purchasers at good price. Farmers prefer commission agents because, if they are

not interested to visit market, commission agent make personal visit to farm and offer good market price. If they are new to the market they prefer any commission agents blindly. Sometimes they prefer to sell dry chillies to village merchants instead of commission agents. Farmers decide well in advance which commission agent to visit to sell dry chili. They choose a right commission agent with the help of other farmer friends based on the payment made on the same day of sales

Farmers take their produce to such market where purchaser's participation is high because, due to presence of E-tendering system at APMC, they ind no harm in choosing any Commission Agent. They choose such commission agent who makes advance payment to Hamaals (labor) on behalf of them.

8. Conclusions

Farmers have reasons for purchasing fertilizers from Government department and the selection of Commission Agent. While preferring Commission Agent they select based on perceived risk of required commission agent. Similarly they choose market based on more number of purchase participation

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