Managing Cold Chain for Perishable Goods for profitability in Selected Outlets of Rajasthan

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Abstract

Indian economy being predominantly agrarian hence cold chain becomes an important infrastructure to preserve perishable items. India occupies top three positions amongst the production of a host of commodities including spices, fisheries, poultry, milk, fruits and vegetables. India's present share in global farm trade is still very small. Approximately, 18% of fruits and vegetables get wasted in the country. This is mainly caused due to lack of cold chain infrastructure which includes both storage and transportation facilities.

 The cold chain industry in India is still at a nascent stage and despite large production of perishables, the cold chain potential still remain untapped due to high share of single commodity cold storage. In this paper, cold chain management is studied at a selected outlet of Rajasthan. Here, the efficacy and benefits of cold chain is empirically tested using various tools, this paper we will evaluate and study the importance of effective cold chain in improving the shelf life of frozen product and increasing profitability of retail store.

Key Words: Cold Chain, Frozen Products ,Nascent,Perishables, retail outlets.

Introduction of cold chain-

India is a country of geographic diversities with varied soil-types, habitats, climates and vegetations. India is a major producer of food (fruits, vegetables, wheat, pulse, milk, spices etc.) in the world. India has an access to a large natural resource base of 161 million hectares of arable land, 15 million hectares of fresh water reservoirs. Due to all these resources, India has become a favorable destination for growth in the processed food industry which requires cold supply chain. The Indian food industry is expected to reach $258 billion from the current level of $181 billion according to the Top Markets Report (2016).

Globally, cold chains have now become an integral part of supply chain management for the storage and transportation of temperature-sensitive goods. There are various utilization of cold chain logistics which includes both cold storages and refrigerated transportation of the perishables. It is being mainly used to increase the shelf life of food produce. With 35-40% of agricultural produce in India being wasted due to lack of proper cold storage facilities, it is immensely important that a focussed effort is required on part of the government to encourage the use of cold chain among market participants (Kulkarni Sateesh, 2016).

Cold Chain

Cold chain is a temperature-controlled supply chain required for various purposes. Cold and controlled supply chain helps to extend as well as ensures the shelf life of products (Khan Farhan, 2013). Cold chains helps in so many ways which are essential for extending the shelf life, period of marketing, avoiding over capacity, etc. It also helps in reducing rush of transport during peak period of production and maintenance of quality of produce.

There are some issues that need our concern and attention, like huge losses in perishables food because of infrastructural deficiencies because of weak, inefficient and inadequate cold supply chains for food. This kind of supply chains requires temperature controlled conditions to retain quality and safety. It helps to curb the decay process i.e. the cold chain.

Cold chain status in Rajasthan

Rajasthan have highest population density among the few tropical deserts of the world. Rajasthan is the land of vibrant colors. Rajasthan is the place where every type of fruit crops are grown. The maximum area occupied for fruit cultivation is for fruits like Mango, Orange, Lime and Guava. Mango is on the top in terms of better agricultural produce yield.

Agriculture (Source: Directorate of Horticulture, Govt. of Rajasthan, 2016)

Area under fruit crops: 2066240 HA

Production of fruit crops: 238134 TONNES

Net area sown: 15,705.700 HA

Gross cropped area: 17, 702,900 HA

Area under potato crop: 24122 HA

Production of Potato: 27897 TONNES

Table 1.2: Status of food processing industry in India

Rank of Industry	5th
Employment in lakhs	16
% of total industrial labour force	19
Total industry output in %	14
Output as % of GDP	5.5
Estimated turnover	1, 44,000 (Rs. In crores)
Unorganized sector	1, 11,200 (Rs. In crores)

Source: fnBnews.com, Top news,2015

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Table 1.1: Area and Production of fruit Crops

Fruit Crop	Area (Hect)		Production (Qtls)
Mango	6493		984934
Guava	1885		226119
Lime	2847		182062
Pomegranate	383		100787
Jamun	253		19092
Amla	397		221932
Papaya	375		33942
Phalsa	48		4539
Orange	5101		342550
Ber	736		46608
Mulberry	29		1689
Grape	20		1238
Sapota	11		257
CustardApple	255		555

Source: Agro Economic research Centre, September, 2011

The Indira Gandhi Canal is being used for the agricultural purpose where crops grown here are irrigated in different districts of Rajasthan state. In the process of metabolism, proteins, carbohydrates, and other nutrients are simply broken down from complex to simpler compounds often resulting in reduced quality or quantity of the foods, through respiration, enzymatic breakdown and microbial degradation. The process of maintenance of cold chain is dependent upon temperature (Lisa Kitinoja, 2013).

We need the facilities of cold chain to cope with the above problems. In India, the cold chain market is anticipated to reach by `624 Billion by 2017 (Lisa Kitinoja, 2013).

The Indian consumer – Change is inevitable

Consumers of today want more value for their money, and now actively seek quality and the attitude of compromise is a thing of the past. As the people want to dispose of their income on food is on the rise, the consumption pattern has undergone a rapid change due to urbanization and changing lifestyle. Moreover, the Processed Products must appeal to an Indian palate. Amongst them are personal motives of consumers, thoughts, feelings attitudes, and decision-making abilities guide of consumption behavior.

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Maintaining the cold chain can provide the following benefits for perishable foods: (Lisa Kitinoja, 2013).

• Transpiration process gets reduced which lessen down water loss, less shriveling

• Reducing ethylene production slows down ripening of fruits

• Cold chain increases resistance to ethylene action

• Respiration of food products gets reduced which may lessens perishability

• Decreases the activity of micro-organisms

• Reduces browning and loss of texture, flavor and nutrients of products

• Delays ripening and natural senescence

Rajasthan has more than ninety functioning cold storages and cold chain maintenance in various departmental stores. The maximum no. of retail and modern retail store maintaining cold chain are functioning in Jaipur along with other cities too. For the present study 94 stores were selected which was a mixed of both modern retail as well as general departmental stores maintaining cold chain.

Research Methodology

Objectives of the Study:

To study the importance of effective cold chain in improving the shelf life of frozen product and increasing profitability of retail store.

Research Type

Inductions and deductions are possible in a systematic research. In the present study, we have used both the methods of study i.e., induction and deduction type of research study.

Research Design

In the present study, exploratory type of research has been adopted in the first step which was followed by the descriptive type of research as very limited study has taken place related to the topic of present research, related to Cold Chain Management specifically in Rajasthan (India) at selected outlets.

Sampling Techniques

Sampling techniques may be broadly classified as Probability and Nonprobability sampling. In the present study, Nonprobability type of sampling i.e. judgemental sampling and snowball sampling had been adopted.

Procedure for Data Collection

Primary data were collected through filling questionnaires from the store managers of various places in Rajasthan.

Sample Size

For the present study, 112 Respondents from 94 retail/store managers were taken. They were interviewed and questionnaires were filled by them.

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Methodology

The data obtained through questionnaires was analyzed by using appropriate statistical tools. The filled up questionnaires were coded and master data sheet was prepared. The survey was done in 94 stores of different stores of Rajasthan from where in totality 112 questionnaires were collected. The data then were tabulated and classified on the basis of independent and dependent variables. The summary statistics of the collected data were presented in systematic manner. Thereafter, different null hypotheses have been developed to identify the influence of certain independent variables on effectiveness of cold chains for frozen food products. Various hypotheses have been derived and were tested. The statistical tests, regression, multicollianarity, VIF (Variation Inflation Factor) analysis will be used for analysis. The five-point Likert scale was used.

Analysis of various benefits of a cold chain on overall profitability of a store:

To check the significance of those variables Multiple Regression (stepwise) has been applied with dependent variables as 'An Effective Cold chain increases the Overall Profits of a retail Store'

The Means and Standard Deviation for Statements related to the Benefits of Cold Chain showed that most of the variables have got a mean value of above 4 and which means that cold chain provides these benefits. The most important benefit of cold chain amongst them has been identified for statements like the **cold chain helps in retaining the moisture of the products (4.53)** followed closely by **protection from bacteria (4.45)** and protection of **products from humidity (4.44). Retaining the nutrients of the products is yet another benefit of the cold chains (4.41). Cold chain also minimizes the spoilage and wastage (4.38), increases the storage and shelf life of the product (4.33), and helps in retaining the freshness of the products (4.31).** The mean value for the variable that **cold chains maintain the quality of the product** has also got a good mean value viz**. 4.19.**

The dependent variables namely – Cold chain increases the profits of the store has been rated high on a scale of 5 by the respondents. It has got a mean value of 4.31.

Impact of Effective Cold Chain Management on Profit of the Store:

It has been found and discussed that which variables under a cold chain affect the profit of the store. To check the significance of those variables Multiple Regression (stepwise) has been applied with dependent variables – **'An Effective Cold chain increases the Overall Profits of a retail Store'**

The lists of null and alternative hypotheses regarding impact of benefits of a cold chain on overall profits were framed. There were 12 such hypothesis. **All alternative hypotheses were directional hypotheses.**

Test for Multicollinearity

Multicollinearity is a problem as normally there should not be such two independent variables that are highly correlated. Multicollinearity was checked with the help of VIF value i.e. Variance Inflation Factor. VIF is calculated with the help of SPSS in this study and the variables with more than 3 VIF value were dropped. VIF is calculated by keeping one independent variable as dependent variable and rest of the independent variables. This process is repeated till **all the independent variables were treated as dependent variables turn by turn.** Each variable played as dependent and independent for calculation

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of cross VIF. All the values of VIF in the table were below 3, which showed that there is no Multicollinearity among the various independent variables.

After this Stepwise Multiple regressions Analysis was carried out by an automatic procedure. The stepwise regression model algorithm adds one independent variable at a time. It began with one, which explained maximum variation in the **"Effective Cold Chain increases the Profits of Retail Store"**(the dependent variable) and continued to add more independent variables to the regression, one-by-one. The model was verified at each step for the best fit and variables ceased to be added once the regression model was optimized(Paul et al., 2016).The forward stepwise regression took five steps to reach model optimization for Benefits of cold chain affecting the profits of the retail stores. The 5th step shows value of R square as .727 which finds that around 73% of the variance is explained by the model, which is quite significant.

The ANOVA statistics was also done. The ANOVA table tells whether the dependent variable is significantly affected by the independent variable. The value in sig. column is .000, which is less than the critical value of p - .05. Hence, there is a significant impact of independent variables on dependent variable. With the value in sig. column (e) is also added with .000, which means that it is significant when the dependent variable is predicted by the five independent variables namely - **Freshness of the products, Increase in storage and shelf life of the product, Protection of the products from bacteria, Minimization of the spoilage and wastage and Maintenance of the quality of the products.**

Table 1.Coefficients (a)

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
5	(Constant)	-.568	.297		-1.908	.059
	It helps in retaining the freshness of the products	.303	.065	.309	4.675	.000
	It helps in increasing the storage and shelf life of the product	.241	.068	.236	3.537	.001
	It helps in protecting the products from bacteria	.234	.064	.232	3.665	.000
	It helps in minimizing the spoilage and wastage	.241	.069	.247	3.488	.001
	It maintains the quality of the products	.106	.031	.175	3.413	.001

A Dependent Variable: Effective Cold Chain increases the Profits of Retail Store

The coefficients table shows which variable out of the total 12 independent variables significantly affect the dependent variable. There were five benefits namely - **freshness of the products, Increase in storage and shelf life of the product, Protection of the products from bacteria, Minimization of the spoilage and wastage and Maintenance of the quality of the products** affect the profitability of the stores significantly.

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Results of the Hypotheses testing:

There were only five benefits/variables which actually affected the dependent variable.

Ho 1 Maintaining quality of the products has no impact on the Overall Profits of a retail store.

Ha 1 Maintaining quality of the products has a positive impact on the Overall Profits of a retail store

The value under significant column of table 1 is 0.01 which is less than the value of 'p' at 5% significance level (.05). Hence, null hypothesis is rejected and alternate hypothesis is accepted. Hence, it may be concluded that maintaining quality of the products has a positive impact on the overall Profits of a retail store.

Ho 4 Protection of the products from bacteria has no impact on the Overall Profits of a retail store.

Ha 4 Protection of the products from bacteria has a positive impact on the Overall Profits of a retail store.

The value under significant column of table 1 is 0.00 which is less than the value of 'p' at 5% significance level (.05). Hence null hypothesis is rejected and alternate hypothesis is accepted. Hence, it may be concluded that protecting products from bacteria has a positive impact on the Overall Profits of a retail store.

Ho 8 Increase in storage and shelf life of the products has no impact on the Overall Profits of a retail store.

Ha 8 Increase in storage and shelf life of the products has a positive impact on the Overall Profits of a retail store.

The value under significant column of table 1 is 0.01 which is less than the value of 'p' at 5% significance level (.05). Hence null hypothesis is rejected and alternate hypothesis is accepted. Hence it may be concluded that Increase in storage and shelf life of the product has a positive impact on the Overall Profits of a retail store.

Ho 10 Minimization of the spoilage and wastage has no impact on the Overall Profits of a retail store.

Ha 10 Minimization of the spoilage and wastage has a positive impact on the Overall Profits of a retail store.

The value under significant column of table 1 is 0.01 which is less than the value of 'p' at 5% significance level (.05). Hence, null hypothesis is rejected and alternate hypothesis is accepted. Hence, it may be concluded that Minimization of the spoilage and wastage has a positive impact on the Overall Profits of a retail store.

Ho11 Retention of the freshness of the products has no impact on the Overall Profits of a retail store.

Ha 11 Retention of the freshness of the products has a positive impact on the Overall Profits of a retail store.

The value under significant column of table 1 is 0.00 which is less than the value of 'p' at 5% significance level (.05). Hence, null hypothesis is rejected and alternate hypothesis is accepted. Hence, it may be

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concluded that retention of freshness of the products has a positive impact on the Overall Profits of a retail store.

Conclusion

The present study is on effectiveness of the cold chain in retail stores in the Rajasthan state. Rajasthan has varied climatic conditions and produces a variety of fruits and vegetables. Hence, the stores may buy a wide variety of goods locally, store them and sell them by using their cold chains as and when required. This was found that the maximum space of the cold chains is filled with the milk and dairy products and beverages. Lesser space is given to the ready to eat and ready to cook products. There are mainly five benefits of cold chain that affect the profitability of a retail store significantly. These Factors were - **Freshness of the products, Increase in storage and shelf life of the product, Protection of the products from bacteria, Minimization of the spoilage and wastage and Maintenance of the quality of the products**. The maintenance of cold chain would certainly increase the profitability of the store.

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