Reducing Bullwhip Effect in Fresh Food Vegetable Supply Chain Management: A Strategic Approach for Inclusive Growth

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***Abstract*— Inclusive growth is the mantra for a country's growth. Inclusive growth itself demands inclusive support from all the sectors of industry and agriculture. But economy of industry and agriculture growth depends on proper supply of goods and food items to the ultimate consumers at right place, right time, right quantity with right price based on effective prediction or judgement of demand. The failure to predict proper demand by a company leads to fluctuation of demand between supply chain stages. This extends to bullwhip effect, which is a threat for economic growth. Nowadays Indian retailing industry is booming with more opportunities and has got increased contribution to the growth of economy. Due to the impact of globalization, Indian retailing formats are seeing metamorphosis. Retailing is getting transformed like India from unorganized to semi organized and organized retailing. Retailing in fresh food vegetable supply is slowly gaining importance in the agricultural based economy. Reaching the fresh food to vast country like India without proper supply chain and infrastructure is a daunting task. Balancing the demand and supply between semi-organized fresh food vegetable (SOFFV) retailers and fresh food suppliers amongst the supply chain activities is a challenging job. Using conjoint analysis this research focuses on different levels of combination of attributes preferred by the semi organized vegetables retailers, based on demand to identify fresh food delivery package with best utility rate. This article helps to understand the efficiency of information sharing to reduce the bullwhip effect.**

***Keywords*—** *Inclusive growth, Bullwhip effect, Fresh Food Vegetables supply chain, FFV delivery Package.*

1 Introduction

Inclusive growth is all about raising the pace of growth and enlarging the size of the economy, while levelling the playing field for investment and increasing productive employment opportunities. In order to obtain a better inclusive growth, the government is required to improve rapid growth focused on labour-intensive industries and small and middle enterprises to create employment opportunities in the manufacturing and services sectors. Companies procure goods and services from the different sources, if companies can closely look at their supply chain and sourcing, they can definitely contribute for the inclusive growth of country, along with that they can get advantage of getting quality goods (also services) and saving in their expenditure, which lead to improvement in their bottom line.

Without higher agriculture growth, India's 10% economic growth target will be impossible to achieve [18]. In addition, higher real incomes lead to higher food consumption, implying more pressure on demand. Reforms undertaken in the early 1990s made India one of the world's fastest growing economies. The boom of the IT industry and improved agricultural production created an atmosphere of optimism, which led to the coining of phrases, such as Incredible India, India Shining, and India 2020 around the end of the millennium. The Indian growth story has been one of high Gross Domestic Product (GDP) growth but primarily driven by the growth in services sector. Not all sectors of the economy have grown at the same pace as is reflected in the relatively low agricultural growth rate, low-quality employment, poor education, inadequate healthcare services, rural-urban divide, social inequalities, and regional disparities. Growth that is not inclusive affects the society, the economy, and the polity. A lack of inclusive growth can result in real or perceived inequities, which has its own social ramifications. Inclusive growth promotes economic growth partly

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by broadening the base for domestic demand and partly by increasing the number of people with a stake in reforms and in a stable government.

1.1 Need of the study

By understanding the different levels of attributes of SOFFV retailers can be well prepared for the shortcomings of maintenance of inventory and response rate. To overcome the lacuna with the knowledge of demand, maintenance of inventory, in-time availability (response rate), cold storage maintenance, purchase frequency with quantity, return- ability of unsold vegetables, Purchase preference, purchase dependency or credit facility, etc., may give a strategic approach to reduce the bullwhip effect in FFV supply chain management.

1.2 Research Objectives

1. To develop orthogonal design for SOFFV retailers delivery package.
2. To derive utility scores of individual factors for different levels of orthogonal design.
3. To reduce high utility rated SOFFV retailers' delivery package.

2 Literature Review

2.1 Inclusive Growth

Inclusive growth is gaining importance as a new concept in development of economies; it has to be defined in a uniform and universally recognized manner. Rapid and sustained poverty reduction requires inclusive growth that allows people to contribute to and benefit from economic growth [15]. Rapid pace of growth is unquestionably necessary for substantial poverty reduction, but for this growth to be sustainable in the long run, it should be *broad-based* across sectors [10], One view holds that as poor people are the least likely to share the benefits of growth, improving their conditions should be a priority in pursuing inclusive growth. Inclusive growth, therefore, should be pro-poor growth. White and Anderson [21] define pro-poor growth as a situation where poor people enjoy higher income growth than other segments of society. Ravallion and Chen [17] imply suggest that any growth that cuts poverty deserves to be called pro-poor. Under this definition, growth should be considered pro-poor unless incomes of poor people stagnate or decline.

2.2 Supply chain management

The term SCM was first introduced in the early 1980s (Oliver and Webber 1982)[16]. In literature it appeared in the mid-1980s (Jones and Riley, 1985[11]; Houlihan, 1985). At the time, the focus was on the supply chain from the point of origin to the point of consumption (e.g. Houlihan, 1988; Ellram and Cooper, 1990[3]; Scott and Westbrook, 1991). More recently, others have emphasized a reversed focus on the supply chain from the point of consumption to the point of origin. For example, Cooper *et al*. (1997)[2], conclude that the term "demand chain" has been introduced to provide additional attention on the customer. The end-consumer should be the focus of the entire supply chain, since all members of the chain are suppliers to the end-user. SCM has achieved the status of a generic term for a business philosophy to implement various systematic processes that create competitive advantages and profitability.

Simultaneous optimisation of all the links in the chain is better compared to total performance of individual links separately optimised. According to Fiala P. [4] says—Supply chain partnership leads to increased information flows, reduced uncertainty, and a more profitable supply chain.

The cooperation is based on contacts and formal agreements. Information exchange is very important issue for coordinating actions of units. New business practices and information technology make the coordination even closer. The supply-chain must effectively perform seven processes: negotiation, transaction, logistics, promotion, information, finance, and manufacturing.

2.3 Agricultural supply chain management

The agro-food sector is in a period of rapid transition and growth worldwide. Internationalization and the availability of new technologies are driving forces (Gert Jan Hofstede et.al,). Many researchers have studied supply chain management problems with theories based on probability. Examples include Fujiwara and Perera (1993), Goh (1994) Ferguson et al. (2006). Ferguson apply Weiss' model to optimal order quantities for perishable goods in small to medium size grocery stores with delivery surcharges. The SCM concept in Fresh Food Vegetables involves movement from farmers to market through

intermediaries to Semi Organized Fresh Food Vegetable retailers to end consumers.

Supply Chain Management (SCM) in general implies managing the relationship between businesses responsible for the efficient production and supply of agribusiness products from farm level to consumers, to reliably meet consumers' requirements in terms of quantity, quality, and price. In practice, this often includes the management of both horizontal and vertical alliances. In developing countries, the supply chain of agricultural products typically involves many players or agents with many farmers at one end and consumers at the other. These traditional supply chains are tightly linked with social structures.

The changes in agribusiness are placing increased importance on the friction in the agribusiness marketplace. One friction of doing business that has increased in importance is the gathering, exchange, and use of information. Information processes in the distribution channel or supply chain are gaining in importance, as the economy is becoming more knowledge based.

2.4 Bullwhip Effect

According to Lee et al.[12],[13], the term 'bullwhip effect' was first used by P&G when they experienced extensive demand amplifications for their diaper product 'Pampers'. Bullwhip effect was first found at Procter & Gamble (P&G), where logistics executives were examining the order patterns of one of their bestselling products, pampers disposable diapers. It is found from the study that the sales at retail levels were fluctuating due to changes in demand patterns. When the same was checked by analysing the order placed by the retailer to the distributors, they could find a variation in the actual products sold and order placed in a specific period of time. On inspection of these orders placed by the distributors to the manufacturer, it was found that the orders varied more and the orders placed by the manufacturer to their supplier had the highest variance. So they observed that while going up the supply chain, the demand variability swings were on the rise and increases at each of these levels in the supply chain. This effect was named as the bull whip effect by the P&G executives as it resembled bullwhip. The bullwhip effect is also known as 'Whip-lash' or the 'whip-saw effect'. To study the amplification of demand information in a supply chain was reported by Forrester [5],[6]. In his seminal work, Forrester reduces the root causes of demand amplification by a double whammy approach, namely, delay in transfer of demand information and then delay in transferring physical product through the supply chain by managing the lead time.

Fransoo and Wouters [7] write that the bullwhip effect refers to the increasing variability of demand further upstream in the supply chain, and conclude that the theory of measurement of the bullwhip effect in a practical setting has received limited attention. The research of the bullwhip effect has considered inter-organizational echelons, such as two-echelons between companies (e.g., Chen et al., 2000; Fransoo and Wouters, 2000[7]; and Yu *et al.*, 2001) or three/multi-echelons between a sequence of companies (Metters, 1997[15]; and Lee *et al.*, 1997a and 1997b)[8],[9], or intra-organizational echelons, such as companies' inbound and outbound logistics flows(Svensson, 2003)[19] in supply chains. In addition Svenson (2003)[19] introduces the term 'reversed bull whip effect' (i.e., increased downstream variability), as opposed to the traditional term 'bull whip effect' (i.e. increased upstream variability). Predictably, as we move away from the end customer, demand volatility keeps increasing. An increase in demand variability as one move up in the chain is referred to *bullwhip* effect. In a typical supply chain, as we move up in the chain from retailers to wholesalers and to manufacturers, each stage in the chain distorts demand and the variability in demand keeping increasing. Thus, though variability is quite low at the final customer end, a manufacturer usually sees high demand variability at his end. We therefore see the behaviour known as the bullwhip effect or the whiplash effect in supply chain literature.

2.5 Fresh food vegetable supply chain practice

In the supply chain management of fresh food vegetables(FFV) produce, the FFV produced by farmers are sold to next inter stage of supply chain i,e., sold basically to APMC market, or daily FFV retail market, secondly to co-operative societies or Hopcoms, thirdly FFV is directly sold to consumers by participating in haats or shaandi's. The ultimate consumers of FFV are purchasing either from shaandi's or weekly haats or from nearby semi organized fresh food vegetables (SOFFV) retail outlets. SOFFV provides the assorted vegetables as

per the consumers required quantity & quality with affordable prices.

Nowadays in urban cities as the working couples, families and elder people are unable to attend these Shaandi's or weekly haats due to distances and busy life schedules, they usually prefer to buy from nearby semi organized retail outlets by calculating the extra price paying against transportation cost and time value. If they go for self-purchase from main market, their consumption rate, availability of varieties, quality of perishable items, quantity they prefer to purchase, against the additional % of money they are spending and time savings, considering these entire factors consumer prefer to buy from nearby semi organized retail outlets. Based on this potentiality nowadays SOFFV are mushrooming. The main reason for mushrooming is, retail outlets are demanding small investments and serves the nearby consumers requirement by arranging assorted vegetables and fruits with good turnover can enjoy the profits.

3 Research Methodology

A Descriptive research methodology was carried to understand the combination of different levels of different attributes.

Sampling unit (Respondents): Semi organized FFV retailers of Davangere city, Karnataka (state), India.
Sampling procedure: Random sampling method was used to select participants.
Sample size: 150 Semi organized FFV retailers in Davangere city.
Statistical technique: Conjoint analysis method was applied to identify the levels of combination of requirements.
Data Collection: Primary data was collected using a data collection tool consisting of Structured questionnaire developed in the form of orthogonal design card.

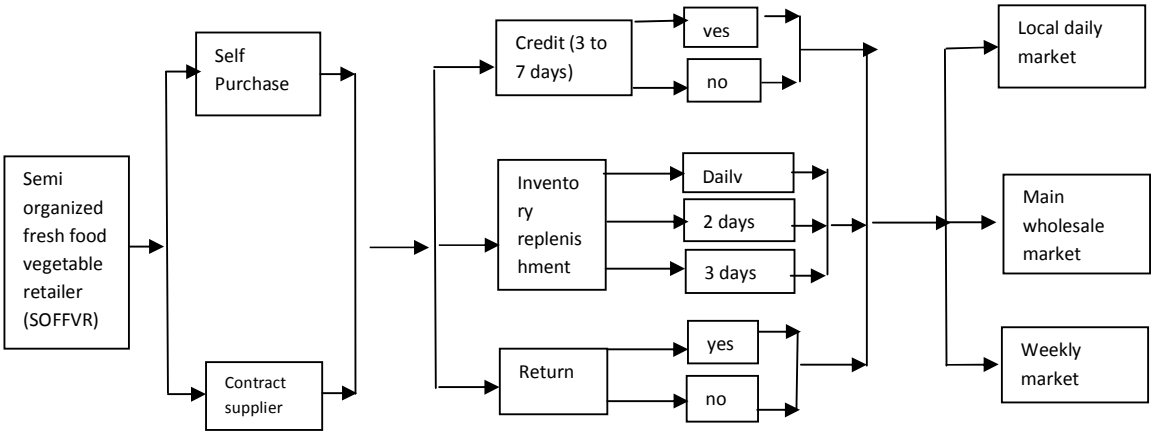

Figure 1: Research model shows flow of information

Research Gap

Compared to Shandi's and organized retail outlets, the cumulative consumption of SOFFV outlets is 60%. Amongst the inter stages of FFV supply chain, the improper coordination and sharing of information contradicts proper identification of demand of the assorted FFV, this creates imbalance. The lacuna found in this process, leads to shortage of inventory or excess of inventory in intermediate channel members.

4 Measure and Procedure

The basic model developed by Uma Devi [20] of 'perishable delivery package' for medium size retailers, is improved by adding few variables to prepare orthogonal design card for "Fresh Food Vegetables Delivery Package". Further in this research it has been tried to analyse the attributes (factors) with different levels. From the preliminary interview, maintenance of one day stock , two days stock or three days stock was found in common. Based on this, 5 variables(attributes) are chosen for the construction of "Fresh Food Vegetables Delivery Package".

The attributes are as delineated below:

1) ***Purchase*:** This factor represents the purchase preferences of retailers from any of the three supply points. i.e., Daily Vegetable Market, Weekly Market and Main Wholesale Market.

2) ***Purchase-Dependence*:** The retailers have two options for purchase of FFV i.e., either they go for Self-purchase or depends on contract suppliers.

3) ***Return:*** This factor represents return practice of the unsold vegetable.

4) ***Credit*:** This factor represents the preference of normal practice of credit period (i.e. from 3 to 7 days).

5) ***Inventory level*:** This factor represents the retailer's preference to maintain inventory turnover levels.

Hence, the factors used in orthogonal design for conjoint analysis is summarized in following table:

Table 1: Variables in Fresh Food Delivery Package Design

Variable name	Variable value	Value label
Return	Return spoilt	No, yes.
Credit	3 to 7days credit period	No, yes.
Inventory	Stock replenishment	Daily, 2days, 3days.
Purchase	Purchase preference	Main whole sale market, weekly market, Daily local market.
Purchase_dependance	Purchase dependence	Self-purchase, Depends on contract suppliers.

Table 2: Orthogonal Design

	Card ID	Return spoilt	credit period	stock replenishment	purchase preference	purchase type
1	1	Yes	Yes	daily	weekly market	procure from contract supplier
2	2	No	No	daily	weekly market	procure from contract supplier
3	3	No	Yes	daily	Main whole sale market	self-purchase
4	4	Yes	Yes	three days	daily local market	self-purchase
5	5	No	Yes	three days	Main whole sale market	procure from contract supplier
6	6	Yes	No	daily	daily local market	procure from contract supplier
7	7	Yes	Yes	two days	Main whole sale market	procure from contract supplier
8	8	No	Yes	daily	daily local market	procure from contract supplier
9	9	No	No	three days	Main whole sale market	procure from contract supplier
10	10	No	Yes	two days	weekly market	self-purchase
11	11	No	No	two days	daily local market	self-purchase
12	12	No	No	daily	Main whole sale market	self-purchase
13	13	Yes	Yes	daily	Main whole sale market	self-purchase
14	14	Yes	No	three days	weekly market	self-purchase
15	15	Yes	No	two days	Main whole sale market	procure from contract supplier

16	16	Yes	No	daily	Main whole sale market	self-purchase
17[a]	17	Yes	Yes	two days	weekly market	procure from contract supplier
18[a]	18	Yes	No	daily	weekly market	procure from contract supplier
a. Holdout						

Table 3: Model Description

	N of Levels	Relation to Ranks or Scores
RETURN	2	Linear (more)
Credit	2	Linear (more)
Inventory	3	Linear (less)
Purchase	3	Discrete
Purchase_Dependance	2	Discrete

5 Analysis and interpretation

5.1 Conjoint Analysis

People value different features that make up an individual product or service, it can be studied by marketers by using a statistical technique known as conjoint analysis. Combination of a limited number of attributes is most influential on respondent choice or decision making and determination of the same is the objective of conjoint analysis.

The commercial use of conjoint analysis in the United States has been documented by Cattin and Wittink (1982) [1]. A controlled set of potential products or services is shown to respondents and by analyzing how they make preferences between these products, the implicit valuation of the individual elements making up the product or service can be determined. These implicit valuations (utilities or part-worths) can be used to create market models that estimate market share, revenue and even profitability of new designs.

It measures complex decision making that requires multiattribute judgements; uses input from nonmetric independent variables to secure part-worths that represent the importance of each aspect of the participant's overall assessment; produces a scale value for each attribute or property.

Conjoint analysis has been used in a wide range of study including attribute interaction, student preference, employee preference for health care packages, pricing of goods, managerial leadership and managerial personality traits. Conjoint studies done by Yu, Jie, Goos, Peter and Vandebroek, Martina L. [22], are well known. Conjoint analysis helps to define the combination of important factors (attributes) levels among interrelationship between the different levels of different attributes in deriving the fresh food vegetables delivery package.

Utility score calculations

Conjoint analysis was done on the preference ranking collected from the respondents. The utility score for each factor level was derived. The higher utility score shows higher preference for the factor. Following table no.4 shows utility scores,

Table 4: Utility Scores of factors

		Utility Estimate	Std. Error
Purchase	Main whole sale market	-.973	.456
	daily local market	-.636	.535
	weekly market	1.610	.535
Purchase_Dependance	self-purchase	-.228	.342
	procure from contract supplier	.228	.342
Return	No	-1.185	.685
	Yes	-2.370	1.369
Credit	No	.979	.685
	Yes	1.958	1.369
Inventory Replenishment	Daily	-.554	.413
	two days	-1.108	.826
	three days	-1.662	1.238
(Constant)		10.021	1.662

5.2 Importance values

The range of the utility values for each item of the factor other provides a measure of importance compared to overall performance. Factors with greater utility ranges play a more significant role than those with smaller ranges. The importance value shows the score of various factors. The values are computed by taking the utility range for each factor separately and dividing by the sum of the utility ranges for all factors. The values thus represent percentages and have the property that they sum to 100. In the calculation, it should be noted that calculations are done separately for each respondents and the results are then averaged over all of the subjects. The averaged importance score is shown below.

Table 5: Averaged Importance Score

Factor	Score
Purchase Preference	33.228
Purchase Dependence	16.095
Return	15.503
Credit	14.690
Inventory Replenishment	20.483

5.3 Correlations

This table displays two statistics, Pearson's R & Kendall's tau, which provides measures of the correlation between the observed and estimated preferences. The table also displays Kendall's tau for just the holdout profiles. Holdout profiles (Two in present case) were rated by subjects but not used by the conjoint procedure for estimating utilities. Instead, the conjoint procedure computes correlations between the observed & predicted rank orders for these profiles as a check on the validity of the utilities.

Table 6: Correlations

Correlations[a]		
	Value	**Sig.**
Pearson's R	.810	.000
Kendall's tau	.410	.014
Kendall's tau for Holdouts	-1.000	.
a. Correlations between observed and estimated preferences		

5.4 Reversals

Reversals show how many participants preferred the reverse of what was expected. While specifying LINEAR models for Return, Credit and Inventory, we choose an expected direction (less or more) for the linear relationship between the value of the variable and the preference for that value. The conjoint procedure keeps track of the number of subjects whose preference showed the opposite of the expected relationship.

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Table 7: Reversals for each factor

Factor	Return	89
	Inventory	33
	Credit	32
	Purchase_Dependance	0
	Purchase	0

6 Simulation Cases

The real power of conjoint analysis is the ability to predict preference for product profiles that were not rated by the subjects. These are referred as simulation cases. Simulation cases are included as part of along with the profiles from the orthogonal design and any holdout profiles.

6.1 Simulations Summary

Based on all the above calculations, it can be concluded that major factors which influence conjoint fresh food delivery pack preference are 'Purchase_Dependance', 'Inventory replenishment' and 'Purchase preference'. Hence these three factors were simulated with varying levels of simulations. The various simulations carried out are summarized in following table 8.

Table 8: Simulation's summary

Return	Credit	Inventory replenishment	Purchase	Purchase_dependance	Status	Card id
No	Yes	Daily	Local daily Market	Contract supplier	Simulation	1
No	Yes	Two days	Local daily Market	Contract supplier	Simulation	2
No	Yes	Three days	Local daily Market	Contract supplier	Simulation	3

Return	Credit	Inventory replenishment	Purchase	Purchase_dependance	Status	Card id
No	Yes	Daily	Main Wholesale market	Contract supplier	Simulation	4
No	Yes	Two days	Main Wholesale market	Contract supplier	Simulation	5
No	Yes	Three days	Main Wholesale market	Contract supplier	Simulation	6

Return	Credit	Inventory replenishment	Purchase	Purchase_dependance	Status	Card id
No	Yes	Daily	Weekly market	Contract supplier	Simulation	7
No	Yes	Two days	Weekly market	Contract supplier	Simulation	8
No	Yes	Three days	Weekly market	Contract supplier	Simulation	9

Return	Credit	Inventory replenishment	Purchase	Purchase_dependance	Status	Card id
No	Yes	Daily	Local daily Market	Self-purchase	Simulation	10
No	Yes	Two days	Local daily Market	Self-purchase	Simulation	11
No	Yes	Three days	Local daily Market	Self-purchase	Simulation	12

Return	Credit	Inventory replenishment	Purchase	Purchase_dependance	Status	Card id
No	Yes	Daily	Main Wholesale market	Self-purchase	Simulation	13
No	Yes	Two days	Main Wholesale market	Self-purchase	Simulation	14
No	Yes	Three days	Main Wholesale market	Self-purchase	Simulation	15

Return	Credit	Inventory replenishment	Purchase	Purchase_dependance	STATUS	Card id
No	Yes	Daily	Weekly market	Self-purchase	Simulation	16
No	Yes	Two days	Weekly market	Self-purchase	Simulation	17
No	Yes	Three days	Weekly market	Self-purchase	Simulation	18

Eighteen simulations were carried out with permutation of *'Purchase preference', 'Purchase_dependance' and 'Inventory Replenishment'*. 3 to 7 days Credit variable was kept as 'Yes' and Return Policy was 'No'.

The simulation results are summarized in Table 9.

Table 9 : Preference Probabilities of Simulation

At Purchase Dependence on Contract Supplier and Purchase Preference from Daily Local Market				
Card Number	**ID**	**Maximum Utility**	**Bradley-Terry-Luce**	**Logit**
1	1	71.1%	35.8%	51.9%
2	2	.6%	33.3%	20.9%
3	3	28.3%	30.9%	27.2%

At Purchase Dependence on Contract supplier and Purchase Preference from Main Wholesale Market				
Card Number	**ID**	**Maximum Utility**	**Bradley-Terry-Luce**	**Logit**
1	4	71.1%	36.1%	51.9%
2	5	.6%	33.3%	20.9%
3	6	28.3%	30.5%	27.2%

At Purchase Dependence on Contract supplier and Purchase Preference from Weekly Market				
Card Number	**ID**	**Maximum Utility**	**Bradley-Terry-Luce**	**Logit**
1	7	71.1%	35.1%	51.9%
2	8	.6%	33.3%	20.9%
3	9	28.3%	31.6%	27.2%

At Purchase Dependance on Self Purchase and Purchase preference from Main Whole sale Market				
Card Number	**ID**	**Maximum Utility**	**Bradley-Terry-Luce**	**Logit**
1	13	71.1%	36.0%	51.9%
2	14	.6%	33.3%	20.9%
3	15	28.3%	30.6%	27.2%

At Purchase Dependance on Self Purchase and Purchase preference from Weekly Market				
Card Number	**ID**	**Maximum Utility**	**Bradley-Terry-Luce**	**Logit**
1	16	71.1%	35.2%	51.9%
2	17	.6%	33.3%	20.9%
3	18	28.3%	31.5%	27.2%

At Purchase Dependence on Self Purchase and Purchase preference from Daily Local Market				
Card Number	**ID**	**Maximum Utility**	**Bradley-Terry-Luce**	**Logit**
1	10	71.1%	35.9%	51.9%
2	11	.6%	33.3%	20.9%
3	12	28.3%	30.8%	27.2%

7 Findings

Due to the innovative use of conjoint analysis, 'Fresh Food Deliver Package' was developed. This helps in not only uniform delivery unit but brings in clarity in order placement and supply as far as semi vegetables retailers are concerned. Still there are certain issues to be addressed:

It can be understood from the utility score table-4 that, the Purchase from weekly market is preferred more than daily local market and main wholesale market. It is surprising that, 50% of SOFFV retailers prefer self-purchase and remaining are purchasing from contract suppliers. At the end of the week there is no return of unsold FFV. The highest utility score for the factor credit is 1.958 which means majority of the respondents would like to run their business with credit purchase.From the matrix it can be observed that an inverse relationship exists between inventory replenishment and utility rate. Less frequency of purchase (3 days) showing the low utility rate of -1.662. The moderate frequency of purchase (2 days) is showing moderately high utility rate of -1.108. The low frequency of purchase (1 day) is showing the highest utility rate of -0.554. This shows that retailers prefer the daily replenishment of stock.
Table 6.2 importance values

Since, the average importance score table 5 shows the proportion of score of each factor for sum of 100, it can be understood that when it comes for preference of importance factors for the purchase of FFV from retailers the first preference will be given for 'purchase preference' and the second preference will be given for 'inventory replenishment', the third preference will be given for 'purchase dependence, fourth preference will be given for the 'return of stock', the last preference will be given for 'credit'. The average importance score enables us to analyse 'Purchase' has the most influence on overall preference. This means that there is a large difference in preference between product profiles containing the most desired 'Purchase (weekly market)' & those containing the least 'Purchase (Main whole sale Market)'. The result also shows that credit plays the least desired importance in determining overall preference. Inventory replenishment is more important than Purchase preference from (Main wholesale market, daily local market, weekly market) Purchase dependence may self or contract suppliers are preferred lower than the inventory replenishment. Since, inventory replenishment is based on the retailer's preference for choice of self-purchase or contract supplier. 'Return' plays a significant role but not as significant as inventory replenishment.

From the table 6 it can be understood that in many conjoint analyses, the number of parameters is close to the number of profiles rated, which will artificially inflate the correlation between observed and estimated scores. In these cases, the correlation for the holdout profiles may give a better indication of the fit of the model. It should be noted that, holdout will always produce lower correlation co-efficient. Also, Pearson's R value of 0.810 shows high degree of +ve correlation among variables, and also shows the validity of the utilities.

The table 7 tells the Return factor showed reversal of 89. This means 89 subjects prefer no return policy. But this is surprise that reversals for inventory & Credit factors were equally considered by 33 & 32 subjects respectively means, inventory replenishment & Credit preference both are strongly, equally correlated. Another surprise is that, Purchase dependence & Purchase from different market shows no reversals. Means they are both constant and depends on inventory replenishment (daily) and Credit period.

The table 9 Gives the predicted probabilities of choosing each of the simulation cases as the most preferred one, under three different probabilities of choice models. The 'Maximum Utility Model' determines the probability as the number of respondents predicted to choose the profile divided by the total number of respondents. For each respondent, the predicted choice is simply the profile with largest total utility. The 'BTL

(Bradley-Terry-Luce)' model determines the probability as the ratio of a profiles utility to that for all simulation profiles, averaged across all respondents. The 'Logit' model similar to BTL but uses the natural log of the utilities instead of the utilities.

Based on all the responses obtained in the study simulation profile 1 (card number 1, ID 4) would be preferred in case of purchase dependence on contract supplier and purchase preference from daily local market or main wholesale market or weekly market. For purchase dependence on contract Supplier with purchase preference from daily local market or main wholesale market or weekly market, the probability preference is the same but at purchase dependence on contract supplier and preference from wholesale market, BTL Model shows higher preference of 36.1%. Similarly, Profile 1 (card number 1, ID 10) would be preferred in case of Purchase Dependence on Self Purchase and Purchase preference from Daily Local Market, Main Whole Sale Market and Weekly Market. At Purchase_Dependence on Self Purchase with Purchase preference from Daily Local Market, Main Wholesale Market, Weekly Market, the probability preference is the same but at Purchase Dependence on Self Purchase and Preference from Weekly Market shows lower preference of 35.2%. So the choice (respondents) led to Purchase Dependence on Self Purchase with Daily Local Markets as the Purchase Preference difference of 0.1% was considered negligible.

The chosen 'Fresh Food Delivery Package' leads two combinations of highest utility scores they are-

UTILITY I: (a) Purchase Preference of Daily Local Market (b) Purchase Dependence on Self Purchase (c) Inventory Daily (d) No returns (e) 3 to 7 days credit.

To calculate the UTILITY I of the final selected 'Fresh Food Delivery Package' we can refer to table 5. If we add the individual utility values, (-0.636) + (-0.228) + (-0.554) + (-1.185) + 1.958 + 10.021 = we get the total Utility Score of 9.376

UTILITY II: (a) Purchase Preference of Main Wholesale Market (b) Purchase Dependence on Contract supplier (c) Inventory Daily (d) No return (e) 3 to 7 days credit.

To calculate the UTILITY II of the final selected 'Fresh Food Delivery Package' we can refer to table 5. If we add the individual utility values, (-0.973) + (0.228) + (-0.554) + (-1.185) + 1.958 + 10.021 = we get the total Utility Score of 9.495

8 Conclusion

One of the major issues to be considered in this study is changes in the purchase dependence leads to two combinations of utility study. It is very interesting that, even though conjoint utility analysis, Purchase preference was estimated to be weekly market, but simulation analysis is exactly as per industry norms, i.e. semi organized fresh food retailer prefer Purchase dependence on self-purchase, his preferred purchasing market is Daily Local Market or Main Wholesale Market as we got difference of 0.1% from BTL Model comparison analysis. i.e. Semi organized fresh food retailer if prefer purchase dependence on contract supplier, his preference first is, supplier should be from Main wholesale market(36.0%) and secondly supplier should be from Daily Local Market(35.9%). As in Utilities table, the Purchase dependence was equally preferred for Self purchase and contract supplier in opposite direction, it leads to differences in scores of UTILITY I and UTILITY II.

This study has shown an innovative way for Fresh Food vegetables suppliers to understand the insights of different levels of each factor in better way. It helps to understand the nature the purchase dependence, Purchase preference and Inventory replenishment with two combinations which helps the respective supplier to make adjustments in the inventory level in better manner to bridge the gap between Supply and Demand of fresh food vegetables supply chain management.

The proper understanding and sharing of information between any two stages of supply chain, leads to reduce the impact of bullwhip effect on supply chain stages. Hence, building such bridge through effective sharing of information

between supply chain stages contributes major efficiency towards increase of overall supply chain surplus, which indirectly joins its hand for the inclusive growth of country's economy.

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