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A STATISTICAL ANALYSIS ON CONFLICTING LOGISTICS OPTIMIZATION IN MANUFACTURING SECTOR

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ABSTRACT

Performance optimization is a crucial issue in present-day manufacturing systems. Here, we reconsider the problem of conflicting optimization goals, with a focus on low inventory levels and short throughput times. The conversion of some performance measurements such as the delivery time and delay time into penalties is generated. When manufacturing is the main an economic activities in an industry, changes in production patterns pose a challenge to the logistics system, forcing manufacturers to optimize the logistics system.. The results illustrate that the optimization models provide the optimal solutions which have lower total costs and require less processing time than the current method. This paper signifies Logistics activities create high cost reducing competitiveness of the company, especially for the remote production base. Shorter processing time, ensured optimal solution, transparency increase and better communication are gained by using these optimization models. However, the proper boundaries must be defined carefully to gain the feasible solution.

Key words: logistics optimization, supply chain and logistics management, operations research,.

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1. INTRODUCTION

Manufacturing Logistics refers to all planning, coordination and service functions required to carry out manufacturing activities. The temporal scope of manufacturing, logistics begins from the point where end-item customer demands are determined, and extends to the point where the demands are fulfilled. In this process, the flow of material, information, and service may move across enterprise, industry and national boundaries. Coordinating the complex variety of activities in this environment poses significant challenges to manufacturing enterprises. While manufacturing, logistics can be viewed as an academic research area encompassing many aspects of operations management and developments in supply chain logistics, it can be also viewed as a domain of ever evolving industry problems that are driven by technological innovations and the global economy. It is this latter view that we set out to explore in this paper. We believe that these expanded directions for manufacturing logistics research offer opportunities for OR/MS professionals to not only generate new knowledge in this rapidly growing research area but to also exert influence on corporate decision-making and software innovation. Even though manufacturing productivity has been a subject of extensive study (c.f., Graves et. al., 1993), most existing research is still encased within the context of domestic, single facility scenarios assuming information technologies and data collection capabilities of the past.

2. OBJECTIVES

The objective of the research made to identify a set of challenges that spanned with all facets of the reverse logistics process.

- To identify the Distance of inventory location from the manufacturing unit.
- To Examine the transport sector and other functions of logistics.
- To understand the importance & strategies of logistics management in detail.
- To study the types of studies on Customer Return Patterns.
- To examine the Availability of Inventory Points .

3. STATEMENT OF THE PROBLEM

The objectives priority of all functions is different which affects on each other's operation. For example, ordering restrictions such as whole pallet purchase may cause higher material and inventory cost. On the other hand, if the ordering amount is not full-pallet, it will cause several problems in warehouse management. Moreover, the insufficient sharing of knowledge and information may not provide the system optimization. Furthermore, some hidden costs such as cost of delay and long transit time are difficult to be determined; consequently, the selection has tended to focus more on the material/service price. Moreover, the current tool works with singular item basis rather than the integrated optimization, so the users need to create the extra tool to make a decision which it has never been proved that is the optimal solution. Finally, decision making efficiency depends on the company's personals' experience and skill. Therefore, standard working process and decision should be set up being assured that all decisions are made in the most suitable way..

4. RESEARCH GAP

This investigation gives an extension of information on the field of turn around coordinations furthermore figures out where crevices stay in the writing. In the wake of checking on the writing and deciding the ebb and flow condition of research and distinguishing conceivable

crevices, the analyst used to decide the positioned key variables to the invert coordinations prepare.

Statistical analysis on logistics manufacturing sector

This paper presents results from statistical analysis conducted utilizing SPSS 16.0 version.

Characteristics, Problems and Challenges of Logistic System Management

The following section discusses the Characteristics, Problems and Challenges in implementation and Management of Logistics. The study has designed questions on the above aspect for collecting the opinion of respondents.

Distance of inventory location from the manufacturing unit

The study has collected the information regarding the distance of inventory location from the manufacturing unit. The choice given to the respondents are 1-10 Kms, 11-15 Kms, 16-20 Kms and 20 and above. The information is detailed in the following table.

Table 1 Distance of Inventory Location

SL. No	Parameter	Frequency	Percentage
1	1-10 Kms	189	47.2
2	11-15 Kms	23	5.8
3	16-20 Kms	69	17.2
4	20 and above Kms	119	29.8
Total		400	100

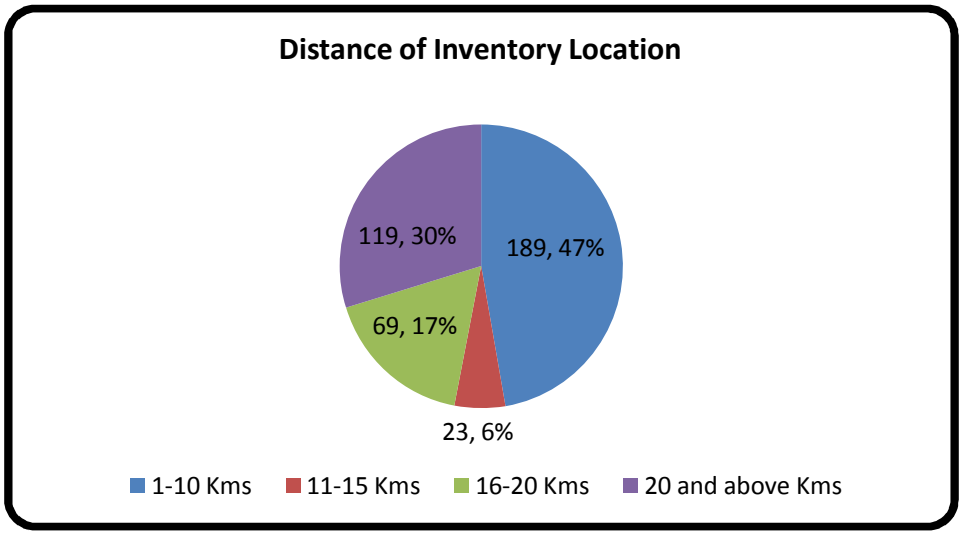

Figure 1 Distance of Inventory Location

It is observed from the above table that 189 respondents opined that there inventory location is 1- 10 Kms far from manufacturing unit (Percent = 47.2). 23 respondents have stated that there inventory is 11-15 Kms far from the manufacturing unit (Percent = 5.8). 69 respondents opined that there inventory location is 16 – 20 Kms far from the manufacturing unit (Percent = 17.2) and 119 respondents opined that there inventory location is 20 and above Kms far from the manufacturing unit (Percent = 29.8). Hence majority of the companies have their inventory location 1-10 Kms far from the manufacturing unit followed by 16 -20 Kms.

Transportation Facilities

The study has collected the information regarding the opportunities for transportation available in the organisation. The study has categorized the transportation facilities likewise Multi-modal Transport, Inter-modal Transport, Combined Transport and Others. The results are been summarized in the following table.

Table 2 Transportation Facilities

SL. No	Parameter	Frequency	Percentage
1	Multi-modal Transport	200	50.0
2	Inter-modal Transport	166	41.5
3	Combined Transport	13	3.2
4	Others	21	5.2
Total		400	100

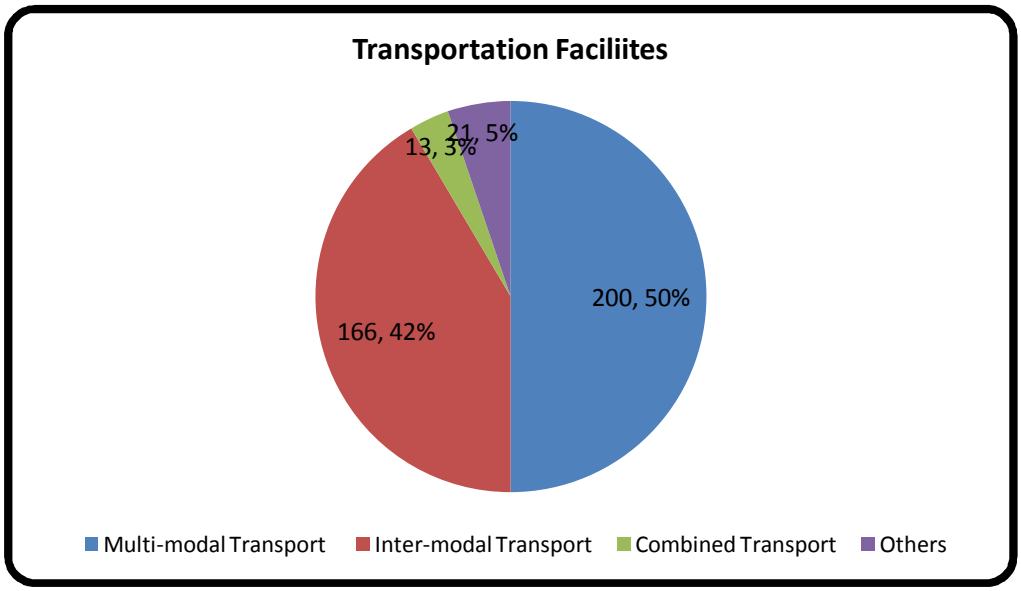

Figure 2 Transportation Facilities

The study results reveal that 200 respondents have Multi Modal Transport facility in their organisation (Percent = 50%). 166 respondents opined that they have Inter Modal Transport system facility in the organisation (Percent = 42%). 13 respondents have opined they have Combined Transport System in the Organisation (Percent = 3%) and 21 respondents have stated they other modes of transportation facilities in the organization (Percent = 5%).

Type of studies on Customer Return Patterns

The following section explains the means followed by organisation in studying the customer return patterns. The study has given choice like Market Survey , Customer's Interest, Brand and Others. The following table explains the results.

Table 3 Type of Studies on Customer Return Patters

SL. No	Parameter	Frequency	Percentage
1	Market Survey	54	13.5
2	Customer's Interest	120	30
3	Brand	209	52.2
4	Others	17	4.2
Total		400	100

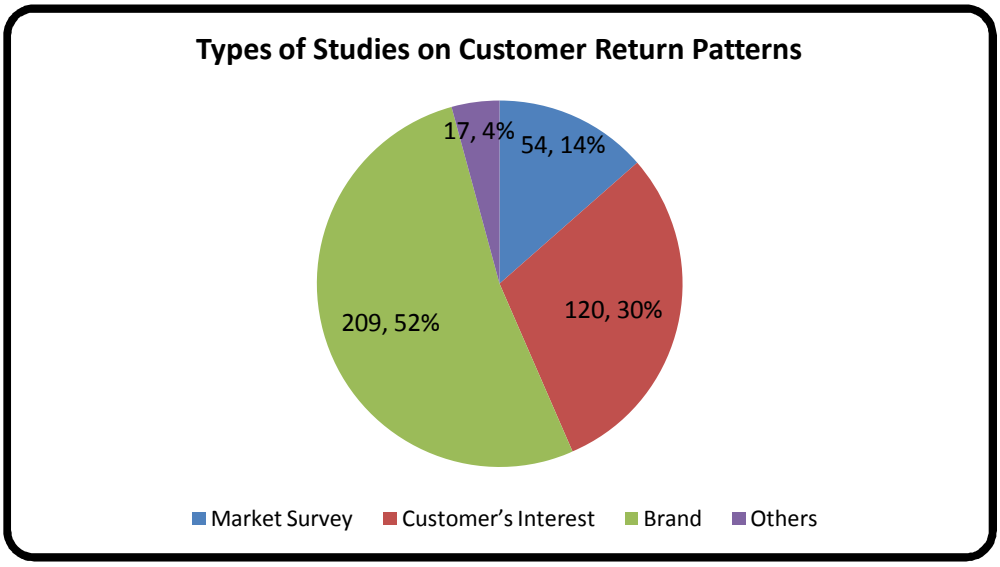

Figure 3 Types of Studies on Customer Return Patterns

The above data reveals that 54 respondents have opined that their organization follows Market Survey for studying the customer return patters (Percent = 13.5). 120 respondents have opined that their organization follows Customers interest (Percent = 30). 209 respondents opined that through brand (Percent = 52.5) and 17 respondents opined they follow other ways in studying the customer return patterns (Percent = 4.2). Hence majority of the organization follows Brand and Customer Interests for studying the customer interest patterns.

Distance from Distributor/Reorder point to Manufacturing unit

The following section details the distance from the distributor point to manufacturing unit. The study has given choice likewise 10-100 Kms, 101 – 200 Kms, 201 – 300 Kms and more than 300 Kms. The following table explains the results.

Table 4 Distance from Distributor/Reorder point to Manufacturing unit

SL. No	Parameter	Frequency	Percentage
1	10-100 Kms	145	25.5
2	101- 200 Kms	153	26.9
3	201 – 300 Kms	29	5.1
4	More than 300 Kms	73	12.8
Total		400	100

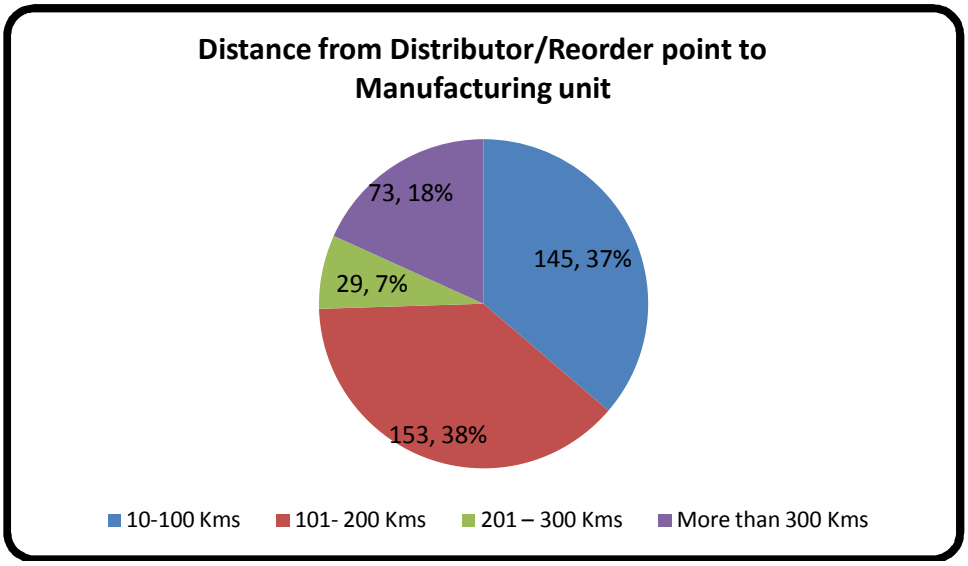

Figure 4 Distance from Distributor/Reorder point to Manufacturing unit

It is understood from the above table that 145 respondents opined that their distributor/reorder point is 10-100 Kms far from the manufacturing unit (Percent = 25.5). 153 respondents opine that their distributor/reorder point is 101-200 Kms far from the manufacturing point (Percent = 26.9). 29 respondents have said a distance of 201 - 300 Kms (Percent = 5.1) and 73 respondents have said a distance of more than 300 Kms (Percent = 12.8) from distributor/reorder point to manufacturing unit. Hence the majority of the respondents of them opined that their distributor/reorder point is 101-200 Kms followed by 10-100 Kms far from the manufacturing unit.

5. IMPACT OF REORDER

The study analyzes the impact of reorder on various aspects of product delivery to the consumer. The choice considered for the study is Product Brand, Quality, Market Need and All of the above. The data analysis results are summarized in the following table

Table 5 Impact of Reorder

SL. No	Parameter	Frequency	Percentage
1	Product Brand	149	37.2
2	Quality	120	30.0
3	Market Need	42	10.0
4	All the above	89	22.2
Total		400	100

It is observed from the above table that 149 respondents have opined reorder have impact on product bran (Percent = 37.2). 120 respondents opine reorder have impact on quality (Percent = 30.0). 42 respondents opine reorder have impact on Market Need (Percent = 10.0) and 89 respondents opine reorder have impact on all the above factors (Percent = 22.2). Hence it can be interpreted that majority of the respondents opine the reorder has impact on Product brand and Quality.

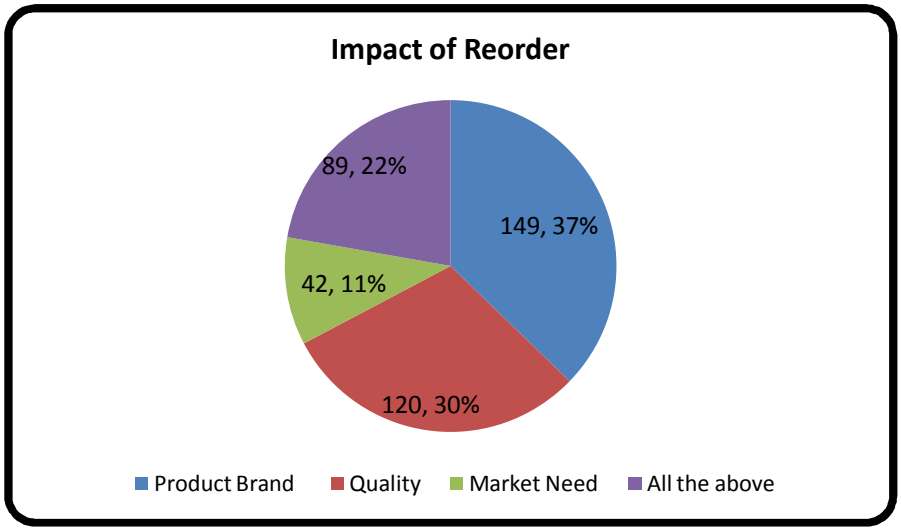

Figure 5 Impact of Reorder

Overlapping of other functions with Logistics

The study collects the opinion regarding overlap of other department functions with logistics. The dichotomous question is been asked, the results are been summarized in the following table.

Table 6 Overlapping of other functions with Logistics

SL. No	Parameter	Frequency	Percentage
1	Yes	233	58.2
2	No	167	29.4
Total		400	100

The above table reveals that majority of the respondents have opinion that other department function have overlapping with logistic function (Percent = 58.2).

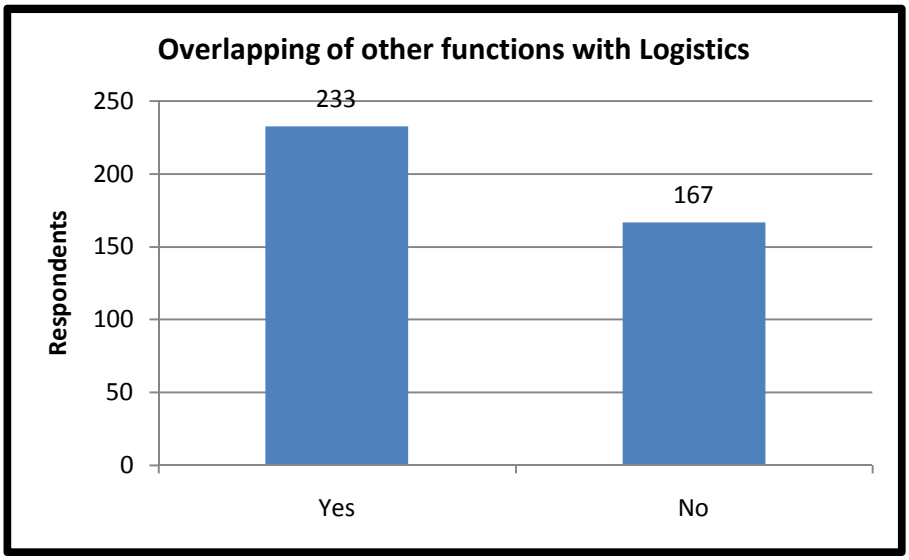

Table 6 Overlapping of other functions with Logistics

Impact of Reliability on Delivery of Product

The study analyzes the impact on delivery variables due to reliability of product. The choices given to the respondents are Increased Efficiency, Speed, Reliability and Customer Satisfaction and All the Above. The results are been summarized in the following table

Table 7 Reliability of Product impact on Delivery

SL. No	Parameter	Frequency	Percentage
1	Increased Efficiency	0	0
2	Speed	157	39.2
3	Reliability and Customer Satisfaction	41	10.2
4	All the Above	202	50.5
Total		400	100

It can be interpreted from the above table that 0 respondents have opined that there is no impact of increased efficiency on product delivery. 157 respondents have opined speed has impact on delivery of product (Percent = 39.2). 41 respondents have opined Reliability and customer satisfaction have impact on product delivery (Percent 10.2). 202 respondents have opined all the above variables have impact on product delivery (Percent = 50.5). Hence it can be understood that Increased Efficiency, Speed, Reliability and Customer Satisfaction have impact on delivery of the product.

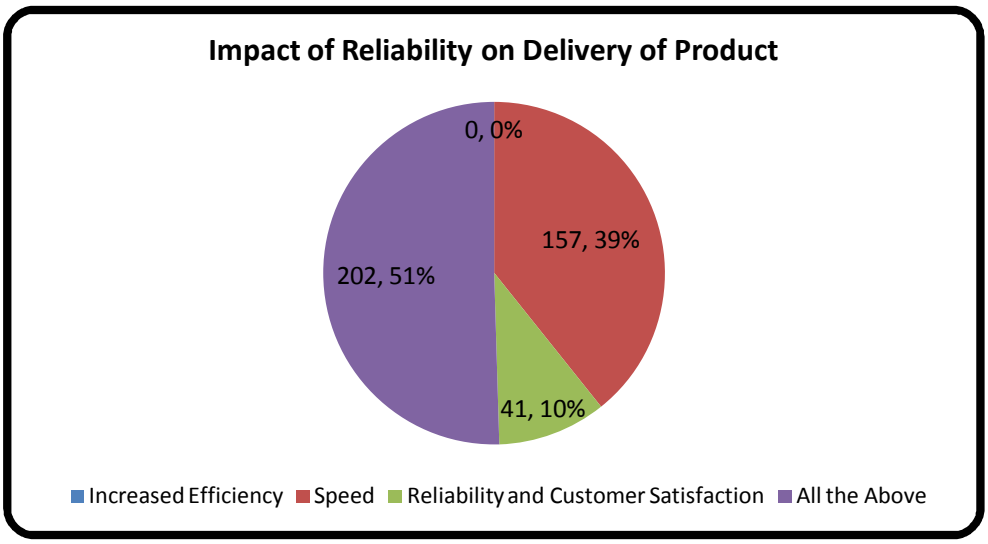

Figure 7 Impact of Reliability on Delivery of Product

6. MODE OF DISTRIBUTION NETWORK

The following section discusses the important node of distribution network adopted in the organisation. The various nodes of distribution network are Warehouse, Franchisers, Other Intermediaries and Others. The results are been summarized in the following table

Table 8 Mode of Distribution Network

SL. No	Parameter	Frequency	Percentage
1	Warehouse	355	88.8
2	Franchisers	1	0.2
3	Other Intermediaries	31	7.8
4	Others	13	3.2
Total		400	100

It is observed from the above table that 355 respondents have stated that warehouse is the node for the distribution network (Percent = 88.8). 1 responded that franchisers are the node for their distribution network (Percent = 0.2). 31 respondents have stated that other intermediaries are the node for their distribution network (Percent = 7.8). 13 respondents have stated that others channels as the node for their distribution network (Percent = 3.2). Hence it can be interpreted that majority of the respondents opined that Warehouse is the node for the distribution network followed by other intermediaries.

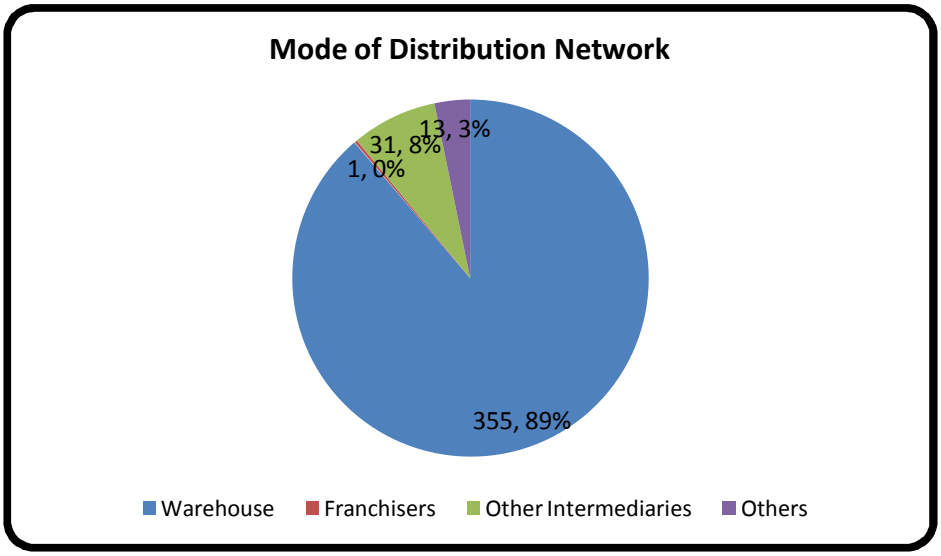

Figure 8 Mode of Distribution Network

Space Holding Cost for Inventories

The study has collected information regarding the space holding cost incurred by their organization in holding inventories. The cost of holding in terms of percentage of inventories is been categorized likewise 0-10%, 11-20%, 21-30% and above 30 %. The results are been summarized in the following table .From the following table it can be observed that 56 respondents stated that they incur 0 -10 % of space holding cost for inventories (Percent = 14.0). 136 respondents have opined that they incur 11-20 % of space holding cost for inventories (Percent = 34.0). 132 respondents have opined that they incur 21-30% of space holding cost for inventories (Percent = 33.0). 76 respondents have opined that they incur above 30% of space holding cost for inventories (Percent = 19.0). Hence it can be interpreted that majority of the organizations are incurring 11-20 % followed by 21-30% of space holding cost for inventories.

Table 9 Space Holding Cost for Inventories

SL. No	Parameter	Frequency	Percentage
1	0 - 10 %	56	14.0
2	11 – 20%	136	34.0
3	21 – 30%	132	33.0
4	Above 30%	76	19.0
Total		400	100

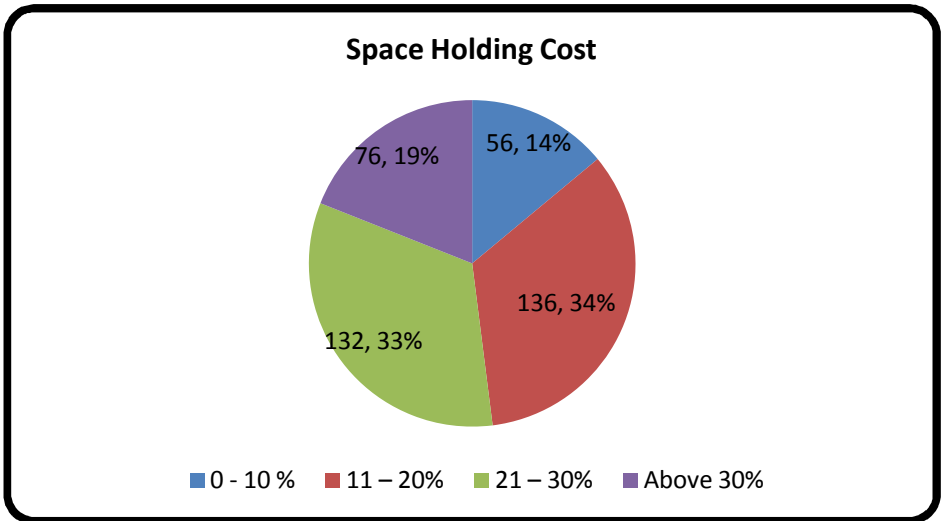

Figure 9 Space Holding Cost for Inventories

Availability of Sensor Technology

The study has collected the information regarding the availability of Sensor Technology in the maintenance of Logistics. The dichotomous results have been summarized in the following table

Table 10 Availability of Sensor Technology

SL. No	Parameter	Frequency	Percentage
1	Yes	43	10.8
2	No	357	89.2
Total		400	100

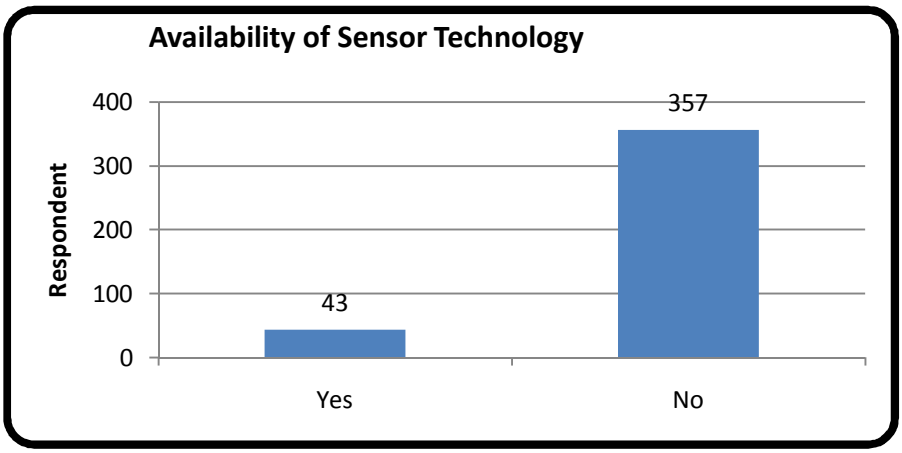

Figure 10 Availability of Sensor Technology

It is observed from the above table results that 43 respondents have stated that they have sensor technology utilized in maintenance of Logistics (Percent = 10.8). 357 respondents have stated that they don't have sensor technology in maintenance of Logistics (Percent = 89.2).

Hence it can be interpreted that majority of the organizations are not utilizing the sensor technology in maintenance of Logistics.

Availability of Inventory Points

The study has collected information on availability of Inventory points for each branch of logistics. The inventory points are divided into four categories as 0-5, 6-10, 11-15 and above 16 inventory points.

Table 11 Availability of Inventory Points

SL. No	Parameter	Frequency	Percentage
1	0-5	55	13.8
2	6-10	143	35.8
3	11-15	129	32.2
4	16 and above	73	18.2
Total		400	100

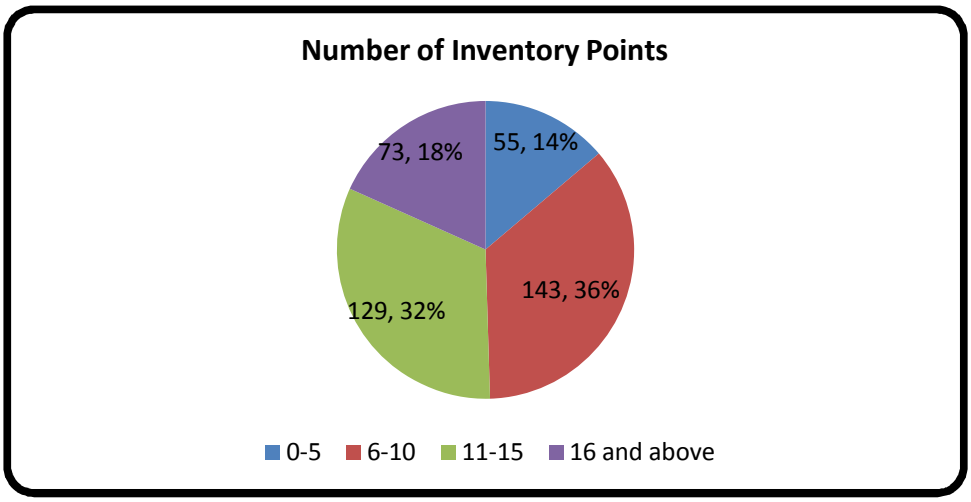

Figure 11 Availability of Inventory Points

From the above table it can be observed that 55 respondents have stated they have 0-5 inventory points for each branch (Percent = 13.8). 143 respondents have stated that they have 6-10 inventory points (Percent = 35.8). 129 respondents have stated that they have 11-15 inventory points (Percent = 32.2). 73 respondents stated they have 16 and above inventory points (Percent = 18.2). Hence it is interpreted that majority of the organizations have 6-10 and 11-15 inventory points maintained in their organizations for each branch of Logistics.

7. SUGGESTIONS

Manufacturing

Traditional perception of manufacturing increases non-production cost in the factory such as inventory cost and facilities investment. Therefore Lean philosophy has been used in manufacturing processes for decades to eliminate waste of which associated cost would be reduced. Recently, many companies have also concerned about agility which is the ability to provide various product types and volume within shorter lead time. To respond to the unstable market, higher cost may be unavoidable. Thus, the company must consider both agility and cost, so-called “flexibility”. Flexibility can be created by several methods such as one piece flow, where a product is made one at a time. Nevertheless, one piece flow cannot be implemented in all processes as a result of process uncertainty. Subsequently, capacity booking which is a reservation of a fixed cycle capacity is agreed in order to produce many

kinds of products according to the real demand. In addition, the lowest-cost products can be produced as work-in process inventory, and then final products which are the higher-cost source will be manufactured only when real demand is known. As a result, the processing time can be decreased.

Distribution

Transport and warehousing were previously perceived as parts of supply distribution. However, distribution is an information-based, valued-added activity which links the marketplace and the factory together. For a successful company, the substantial task of distribution is demand management which is the process of anticipating and fulfilling orders against defined customer service goals . Demand management performance is a consequence of information input quality which comprises sale forecast, production schedule, inventory status, and so forth. Thus, improved information system is increasing information accuracy and reinforcing response speed. Quick response has been invented in order to enable an organization to achieve cost reduction and quicker response of which real demand is shared throughout the supply chain. In order to respond more rapidly, the amount of product transported must be smaller; it results in higher transport cost, but lower inventory cost. Trade-off between transport and inventory cost must be designed carefully to reach the company's strategies. In addition, postponement can gain more flexibility and minimize inventory by producing generic products for the whole market and assembling customized products to response to the real demand.

8. CONCLUSION

The current market condition increasing the significance of 4 major logistics performances which are the delivery time, delivery cost, delivery quality, and delivery utilization; the supply chain and logistics functions need to achieve all performances with the minimum total cost. The alternative selection process which combines the total logistics costs, performance measurement, and systems optimization concept altogether is constructed to ensure the optimal decision making in the logistics operations Because the current tool, SAP, executes material requirement planning with singular item basis while the overseas shipment combines all materials of the same supplier together; the extra and manual calculation has to be done in the spreadsheet by the material planners to plan the delivery that has the least cost and meets required inventory level. To ensure the efficiency of the process, the standard optimization tools for delivery planning are developed in this paper.

Generally, the optimization tools in this paper are developed with the intention to optimize the overall logistics cost including the intangible costs. Furthermore, desired objectives have been considered and converted into costs for comparison and all related information from every function in the supply chain has been shared to create the process alignment and gain better communications which are the important characteristics of the responsive supply chain.

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