The modern industrial scenario warrants the firm to operate in a resource constrained environment & still sustain its competitive edge over others through benchmarking of its logistic centric parameters. The industrial benchmarking philosophy for distribution & warehousing logistics holds the utmost potential to minimize the total logistics costs. Through the determination of the critical parameters that have significant effect on company’s logistics operations, comparing them with the best of the best player in industry & the industry average and channelizing resources & directing efforts for enhancement of that parameter(s) along which the firm is lagging will prove to be a valuable input for strategic planners of the company for competitive advantage.

Modern day business scenario characterized by immense competition with the advent of globalization & liberation poses multitude of challenges for manufacturing industry. Global manufacturing practices have witnessed a paradigm shift towards customer based competition wherein not only the cost , price & productivity are the only parameters of importance but also the product quality as well as time needed to design, manufacture, deliver and maintain the product or system have emerged as critical parameters influencing the success of a manufacturing enterprise.

Therefore, it assumes utmost importance for a manufacturing industry to ensure effective and economic delivery of quality products to customers in a resource-constrained environment in order to retain competitive edge over than competitors for its survival & growth. Moreover, because of high technological context in modern day products, the manufacturer are required to shoulder additional responsibility to provide post sales support to the customers in terms of maintenance, servicing, spare/ repair parts etc.

The inclusion of logistics consideration at the program inception phase holds the maximum potential to minimize life cycle cost of the system along with the development of the optimum system configuration that fulfils the prime mission related activities and
functions expected of the system. Moreover, this helps develop the better package of logistic support elements in the form of maintenance plan, equipment, facilities & personnel that provides effective support for the system at different phases of system life cycle.

Other than the materials movement, storage & flow into through & outside the firm, the logistics function is responsible to provide continuous & effective support to the system & the product that are sold to customers. Therefore the maintenance & support infrastructure becomes a critical factor in order to minimize major components of life cycle cost that are incurred during system operation & utilization phase. This maintenance & support package developed in conjugation with the system design & development helps minimize the future costs of failures & repair/replacement etc. It also provides support to the customers after the transfer of product ownership in optimal manner.

The incorporation of logistic function in an organization is helpful in coordinating the activities of other functional areas that ultimately strive to achieve the overall goal of the enterprise.

The integrated logistics support resolves the conflict amongst the other functional areas that are interested in optimization of objectives of their individual functions. The integrated logistic support that acts as coordination & conflict resolution mechanism, aims at optimization of overall goals of the organization even though the individual functional goals are sub optimized.

This framework of systematic incorporation of logistics consideration in system life cycle, the development of logistic function, its organizations & integrations within the organization & its interface with environment to anticipate the future environmental factors and their impact on the firm in future, provides tremendous competition edge to the manufacturing enterprise to operate effectively & economically in competitive & resource constrained business environment.

The importance of achievement of strategic fit between competitive & supply chain strategies cannot be over emphasized in modern business environment wherein the firm is faced with ever shifting demand of customers, that is required to be met with minimum
possible resource expenditure. It focuses on a strategic decision making problem, the product mix problem, having the conflicting objectives pertaining to maximization of cost efficiency & the product availability. These objective correspond to cost efficiency & responsiveness frontier of strategic fit zone where the company’s supply chain ought to operate.

The problem is considered to be a multi-criteria decision- making problem. One of the multi-criteria decision- making problem is goal programming wherein the values of the goals are required to be stated beforehand the problem formulation exercise is initiated.

In the absence of the numerical values of the goals that need to be attained, the Pareto optimality approach is adopted. Through Pareto optimality technique firstly the usual solution space to the given problem is defined as per the constraints. Based on the solution space the image of feasible region is formed wherein a set of non-dominated points in criterion space is defined. This series of non dominated points referred to as Pareto curve contains the best compromise Pareto optimal points that is obtained by minimum of the maximum deviations approach.

This framework helps in making strategic decisions of supply chain within the strategic fit zone. As this approach ensures that strategic decisions are made in consonance with the strategic fit zone of supply chain, the downstream decisions such as palling and operational will to also be in accordance with the strategic fit zone due to the fact that these decisions are based on upstream decisions made through the decision making pyramid of the organizations.

For sake of convenience of presentation a linear programming formulation is chosen in the analysis, however the framework is capable of handling more than two conflicting objective criterion and non linear problems in multi-criteria decision making problems.

The possible future extension of the work is to assign priorities to the objective function according to their relative importance to get a solution in more complicated business situation. The priorities may be given in the form weights to various objectives functions after thorough analysis of multiple objectives of the firm.
The part family formulation & associated machine grouping problem for design of cellular manufacturing layout. Towards this end analysis of various coefficient to measure the similarity between machines is performed and the relative matching coefficient is selected for further computations as it posses all the requisite properties to numerically express similarity between machines based on machine-component chart.

Formulating the problem as of maximization of sum of similarities amongst machines, the average linkage clustering algorithm is used to group together machines in a step by iterative process. As the similarity coefficient between groups & part families are formulated at the certain minimum value of similarity coefficient. The solution is verified by grouping efficiency parameter and the layout is proposed for a given data on machine-component chart.

The similarity coefficient chosen (relative matching coefficient) outperforms other in meeting the required properties of no mismatch, minimum mismatch, no match & maximum match. The formulation of the problem consist of setting minimum level of similarity coefficient till clustering of machine should continue, otherwise the algorithm will result in the formation of cluster of all machines under consideration on into a single group.

The average linkage clustering algorithm is superior than other approaches due to the fact that it continues grouping the machine/group based on average similarity to all pairs involved. Moreover the efficacy of solution is verified by calculating grouping efficiency parameter to corroborate the solution obtained by application of algorithm. This indicates the extent to which the inter-cell moments of parts are discouraged. Finally the layout is prepared based on some logical steps guided by the similarity coefficient measure amongst machines/groups ensuring minimum material handling, backtracking, in-process inventory and manufacturing lead time.

The determination of minimum level of similarity by coefficient is one dimension of future extension of the model. The modeling of job arrivals, setup times & job processing times as random variables is another dimension worth exploration by future researchers.

It analyses the situation where it is required to optimize system reliability through some available maintenance actions that are performed between two successive missions of
known lengths. The model incorporates the vital assumption that the components having increasing failure rate, decreasing failure rate and constant failure rate items. Recognizing the fact that the system reliability that is built into it the design state, shows decline during utilization phase and the maintenance actions strive to sustain the system reliability at the acceptable level, a model is formulated with the objective of maximization of the system reliability along with the constraints associated with the maintenance alternatives.

Through Monte-Carlo simulation approach, the model provides the solution to the problem as to which of the available maintenance action should be performed on individual component based on their status and their life at the end of the mission to maximize reliability.

The result indicates decline of system reliability during its usage and the level at which the system reliability may be sustained through through optimal maintenance between successive missions.

The model is helpful in estimation of the achieved reliability for production, maintenance or transportation equipment that are required to perform their function under more severe operating conditions than anticipated during design phase. Moreover, it is helpful in providing a vital input to the designer as to what value of the reliability should be assigned to the system during design stage to get the system exhibit the desired level of reliability during utilization phase.

The model may be extended to incorporate maintenance time that are randomly distributed and multiple system competing to the limited resources and the degree of deterioration on components with every mission to take this research area forward in optimizing system reliability and availability.

It examines the case of determination of optimum number of spares to be held at the system usage site, the replenishment of inventory of multiple user location from a central depot and the inter location transfer of spares in emergency situations. The development of model is based on the assumption that the time required to produce spare from central depot is greater then the time to ship spares amongst user locations. The initial portion of model explores the cost & availability implications where a single spare is transshipped.
Afterwards the analysis is extended to incorporate more than one spare transfer amongst user locations.

The model specifies a critical value of inventory above which the inter location transfer of spares can be effected without compromising availability consideration. The model also accept the fact that the user locations procure the spare parts from central depot in economic order quantity and the average demand during the lead time is assumed to be normally distributed. The setting of reorder level is done for 99% probability of no stock out during the lead time.

The feasibility of inter location transfer depends upon the maximum on hand inventory level. In this way the model addresses two important aspects in determinations of optimum inventory levels for spares namely the achievement of desired system availability & minimization of inventory associated costs through inter location transfer of spares. The model lends itself to further extensions through incorporation of time taken to acquire spare from central depot, the time to ship spare between two locations and the time to restore a, failed equipment to operating state through maintenance/repair action, to provide more meaningful insights in this area of spares provisioning & system availability optimization.

It represents a snapshot of the problem logistic support provider fulfilling demand of multiple consumers for spare parts. The demand placed on the logistics support provider is assumed to be approximated by geometric Poisson distribution that incorporates batches of demand for spares in contrast to simple Poisson distribution. Another important feature of Geometric Poisson distribution is that its variance exceeds its mean, which confirm to the fact that data observed in field too has the same characteristics. While considering demand rates of items, replenishment times & cost simultaneously, a model is developed foe setting cost effective inventory levels for all items to attain the desired overall fill rate.

In order to maximize scale effectiveness with respect to overall costs, the optimization algorithm gives increment to the scale of existing spare scale unit based on component improvement factor, through marginal utility approach. Once the target fill rate or cost limitations are reached the new scale of that group of items whose existing scales have
not been increased. For this group the inventory level is decremented unit by unit based on component degradation factor till the targeted fill rate effectiveness and the overall cost minimization objectives are reached.

The framework has the additional benefits that it can adopt a minimum scale for some of all items if specified as management policy input. The model yields the inventory levels for all items in the range rates then individual items. This capability of computing cost effective scale for all items rather than one component in isolation, enables the model to incorporate a very large number of spares. The sensitivity analysis performed on the model, for changes in mean time between failures, replenishment times & the variance to mean ratio of demand for all items, reveals the soundness of model with respect to changes in input parameters.

The incorporation of the probability of shock outs at the logistic support providers end along with the stock out cost implications for the range of items may prove to be important aspect in future extensions of the model.