CHAPTER 3
AIMS AND OBJECTIVES OF PRESENT INVESTIGATIONS

3.1 TWO STAGE SUPPLY CHAIN

An important phenomenon in supply chain management which is known as the bullwhip effect suggests that demand variability increases as one moves up a supply chain. In this research contrasts the bullwhip effect for a two-stage supply chain consisting of one supplier and two retailers under three forecasting methods based on the market share. To quantify the correlation coefficient between the two retailers clearly, in consideration of market share. The two retailers both employ the order-up-to inventory policy for replenishments. The bullwhip effect is measured various forecasting methods.

![Fig 3.1: A model of two stage supply chain](image)

3.2 Three Stage Supply Chain

The Present work is mainly concentrated on the study of the influence of bullwhip effect in supply chain for variability of order quantity and variability of demand at the customer. The effect is simulated for three stages of supply chain by assuming sudden rise in the demand and sudden fall within the limits of the normal distribution. Low variability of the demand will not give any significant effect on the performance of carrying cost, shortage cost, and inventory total cost at stages of the supply chain. But larger variability of the demand will significantly effect on the performance of the supply chain.
Here in a new supply chain model with a three-stage supply chain system with one supplier, one intermediate warehouse and two retailers with periodic review is employed (Fig. 3.2). In this system, the supplier distributes products of single type to the warehouse. Two Retailers which both follow the auto regressive model (AR(1)) to estimate the demand and apply the order-up-to stock policy, then, the warehouse supplies the products to retailers_1 and retailers_2, who have market share of the customer demand, $\alpha$ and $1-\alpha$, respectively. In this study, it is assumed that: (1) retailers’ orders are replenished instantaneously by the warehouse when the orders are received by the warehouse; (2) there are fixed order lead times for orders placed by the warehouse; (3) the length of lead time is an integer multiple of the inventory review interval; (4) the warehouse employs a base stock policy, a simple order-up-to inventory policy; and (5) demand is forecast by the warehouse using AR(1) model as it is Moving Average (MA) and Exponential Smoothing (ES) and results of AR(1) model are chosen minimum mean squared errors (MMSE). In this thesis study factors are, demand forecasting technique, demand distribution type, ordering cost, holding cost, backorder cost, and demand mean, demand variance, number of forecast periods, lead time, review periods and service level, Bullwhip effect is measured for different ordering policies. A model to study the bullwhip effect for three different forecasting techniques is developed in chapter 4. Here parameters considered are the impact of varying lead time, the first-order autocorrelation coefficient($\phi$), the constant of the autoregressive model ($\delta$), smoothing constant ($\beta$).

In this work two supply chain models are considered (1) model without intermediate warehouse and (2) model with Intermediate warehouse, when the lead time of warehouse is equals to that of supplier then both the models under consideration will have the same measure of the Bullwhip effect (BWE). Inventory carrying cost of the supply chain in both the models are computed and compared through simulation using MATLAB. It is proved that existence of
intermediate warehouse no way be beneficial if the lead time of warehouse and supplier are same. Therefore, the total inventory cost for the warehouse in the three-stage supply chain with the warehouse and the total inventory cost for the two retailers in two-stage system without the warehouse are compared. It be supposed to be noted here that the inventory cost function developed on this focuses only on when lead time at the warehouse, lead time retailer_1 and retailer_2 are equal. The MATLAB software is used to simulate the Bullwhip effect.

The thesis comprises a complete Supply Chain literature review, followed by with a chapter 4 to explain simulation in detail, and then results are analyzed, conclusions are presented in the last chapter.

Finally different analyses are made to have valid and accurate results and comments for the influence of different Supply Chain strategies on Bullwhip Effect for different ordering policies. The supply chain model here comprises two aspects. To start with using three different forecasting techniques. Namely moving average, minimum mean squared errors, exponential smoothing. Product demand estimation is done for retailers the best techniques with MMSE, is selected, there by developed the model to study the impact of φ, market share α, smoothing parameters β and lead time l.