CHAPTER 7
SUMMARY, CONCLUSION & FUTURE SCOPE

7.1 Two-stage supply chain system conclusions

Earlier researchers studied the bullwhip effect under different forecasting methods. However, the previous researchers did not consider the impact of market share. In this work, we investigated the effect of the market share $\alpha$, the autoregressive coefficient $\phi$, and the lead time $l$ on a bullwhip effect measure in a simple two-stage supply chain with one supplier and two retailers, and the two retailers both employ the order-up-to inventory policy for replenishments. It is proved and evident that smaller the lead time $l$, smaller the bullwhip effect is under three different forecasting methods. If the MMSE forecasting method is used, increasing autoregressive coefficient $\phi$ does not always reduce the bullwhip effect when the market share $\alpha$ or lead time $l$ is varying. But increasing autoregressive coefficient $\phi$ can reduce the bullwhip effect effectively using the MA or ES forecasting method. Not only the autoregressive coefficient $\phi$ and lead time $l$ affect the bullwhip effect, but also market share $\alpha$ and the moving average periods ($k$) are two key factors to influence the bullwhip effect. Under MMSE and ES forecasting method, the bullwhip effect can be reduced when the intense competition between the two retailers occurs. However, the bullwhip effect is proved to be maximum value when the intense competition between the two retailers occur using MA forecasting method. Moving average periods ($k$) is proportional to the bullwhip effect when the MA method is used, and it is inversely proportional to the bullwhip effect when the ES method is used. And the bigger the $k$ is, the smaller the bullwhip effect. Above analysis suggest that the bullwhip effect cannot be reduced by simply increasing the autoregressive coefficient. There is need to consider other parameters that affect the bullwhip effect as well. The MMSE forecasting method is likely to be the best method to qualify the bullwhip effect when the $k$ value is lower. But with the increase of the $k$ the ES forecasting method seems better than MA. And with the increase of the value of $k$, the bullwhip effect under the MA forecasting method turns into the lowest. At the end it’s pointed out, we must point out that quantifying the bullwhip effect and investigating its behavior are helpful for reducing the influence of the bullwhip effect in supply chains. However,

Firstly, in return controller has to pay more attention and invest more for investigations of this kind to go for better savings.
7.2 Three-stage supply chain system conclusions

Measuring the impact of the intermediate warehouse on the bullwhip effect and on inventory cost in a supply chain is very useful in practice. In this research, examined the effect of the existence of an intermediate warehouse on the bullwhip effect in the supply chain by investigating the bullwhip effect behavior of a supply chain with one supplier, one intermediate warehouse and two retailers as well as that of a supply chain with one supplier and two retailers. Moreover, computed the effect of the intermediate warehouse on the inventory cost in the supply chains under the assumptions that the demand processes follow an autoregressive model, AR(1), and that the downstream member(s), i.e., either the retailers or the warehouse, implement the base stock policy for their replenishment. Following inference on of the bullwhip effect and the effect of the warehouse on the inventory cost. (1) The use of the warehouse in a supply chain does not help to reduce the bullwhip effect when the order lead times of all downstream members are equal. (2) In the system without the warehouse, the bullwhip effect of a supply chain with one supplier and two retailers is exactly identical to that of a supply chain with one supplier and one retailer, if lead times of the retailers are equal. When the order lead times of the retailers differ, the bullwhip effect exists only if the autoregressive coefficient of the demand process is positive. Furthermore, as the market share of the retailer with a longer lead time increases, the impact of the bullwhip effect on the supply chain increases. (3) The intermediate warehouse does not always help to reduce the inventory costs in a supply chain. Inventory cost savings obtained by the employment of the warehouse depend on certain parameters of the demand process, such as the mean ($\mu_w$) and standard deviation ($\sigma_w$) of customer demand, the autoregressive coefficient $\phi$, the order lead time $l$, and the desired service level at the downstream members.

Identifies in this research are somewhat contradictory to the sensitive presumption that the intermediate warehouse usually helps to reduce the bullwhip effect and inventory system costs. Assumed here both retailers compete with each other in the same market region and their market shares are nearly fixed and carried at the study.

7.3 Findings of the Study in Brief/Supply Chain-Strategies:

1) When retailers’ lead times are small, bullwhip effect is proved small, irrespective of value of market share ($\alpha$) in fig 4.3.
2) For lower values of and higher values of autoregressive coefficient (\( \phi \)), bullwhip effect is recorded low. But, for medium values of autoregressive coefficient (\( \phi \)), bullwhip effect has been high as shown in fig 4.4.

3) To have minimal values of bullwhip effect, lead times of retailers are to be small and extreme values of autoregressive coefficient (\( \phi \)), are always better.

4) Bullwhip effect can be low for higher values of market share and autoregressive coefficient (\( \phi \)).

5) Bullwhip effect when under moving average forecasted retailers demand, larger values of \( k \) (number of moving periods) gives better values of bullwhip effect as shown in fig 4.6.

6) When bullwhip effect studied is under exponential smoothing forecasted demand, bullwhip effect is recorded low for lower values of \( \beta \) (smoothing constants) as shown in fig 4.11.

7) Hence, higher values of market share, lower values of lead time \( l \), higher values of autoregressive coefficient (\( \phi \)) results in significant improvement of bullwhip effect and savings in inventory system costs.

8) The use of the warehouse in a supply chain does not help to reduce the bullwhip effect when the order lead times of all downstream members are equal.

9) Inventory cost savings obtained by the employment of the warehouse depend on certain parameters of the demand process, such as the mean \( (\mu_w) \) and standard deviation \( (\sigma_w) \) of customer demand, the autoregressive coefficient \( \phi \), the order lead time \( l \), and the desired service level at the downstream members.

7.4 Limitation of this work & future scope

This is limitation of this work, research can be extended by considering more retailers and their market shares different in different regions.