ABSTRACT

In this work, we analyse arborescent multi-echelon inventory systems with a view to achieve the following objectives :
(i) an indepth and comprehensive literature review of multi-echelon arborescent inventory systems, (ii) highlight the importance of several aspects involved in the design and control of multi-echelon inventory systems, (iii) discuss METRIC model and its extensions, (iv) discuss Warehouse Retailer models, (v) study a real-life case of a multi-echelon inventory system from Industry, (vi) present simulated multi-echelon inventory systems and (vii) design a Decision Support System for a multi-echelon inventory system.

The literature review spans for a period of about three and a half decades. We have classified the models found in literature into seven categories: (i) Early models, (ii) METRIC Model and its extensions, (iii) Continuous review models of (S-1, S) type, (iv) Continuous Review models of (s, S) type, (v) Periodic Review models, (vi) Warehouse-Retailer models and (vii) other models.

All the aspects that are responsible for the differences in multi-echelon inventory systems are identified, examined, analyzed, and have been classified into the following seven groups: (i) total system or structural parameters, (ii) item

parameters, (iii) repairable or consumable nature of items, (iv) stocking location parameters, (v) measures of performance (vi) demand process, (vii) replenishment policies and (viii) concept of strata and layers.

For further analysis in the thesis, we have considered two types of multi-echelon inventory systems - (i) METRIC models which are multi-item, multi-echelon, multi-indenture models basically used for high-value, low-demand repairable items in spare parts logistic systems in Defence and (ii) Warehouse-Retailer models which are multi-item multi-echelon models basically used for consumable items in physical distribution logistic systems.

We analysis METRIC, MOD METRIC and VARI-METRIC models and their extensions which include relaxations of some assumptions and conditions. A comparative study of these models has been presented by testing them on a few constructed numerical examples.

We discuss Warehouse-Retailer models dealing with both the design and the control aspects of the system. A model has been formulated for a three echelon arborescent system and tested on numerical examples.

We present a real-life case study from Industry. The data has been collected from a large automobile manufacturer. A multi-echelon inventory system from this company has been analyzed from an overall management perspective.

Simulated models are formulated for a few types of multi-echelon inventory systems. The final part of the thesis deals with the designing of a Decision Support System for a physical distribution logistics inventory system in Marketing.

At the end, we present the conclusions of the study and also indicate the areas where further research could be persued.