Abstract

Conventionally, most of the classical inventory modelling and optimization work has assumed that the product is a non-changing entity with a constant life cycle and a constant demand. However, as elaborated above, we know that this is not true in the modern world where we observe that the successful products in the market are generally substituted by newer generation products. We have plenty of such examples: televisions, cellular phones, computers, video-game consols, etc. The demand of these products is governed by the lifecycle dynamics, and thus, best explained by the innovation diffusion theories. Managing the supply chain of such products is a big challenge for the manufacturers and distribution partners involved in their business transactions.

Numerous extensions of the Basic EOQ Model have been worked upon since the time Harris came up with the basic model in 1913. One of those is the adaptation of this Model to the non-constant demand rate (time-dependent, credit-dependent, stock dependent, price dependent, etc.). Another extension is the consideration of multiple items in the inventory replenishment decisions that encompass assortment optimization and inventory optimization, with related dynamics of pricing, capacity, etc. Multi-item inventory models deal in the management of more than one product in the supply chains. There has been substantial amount of research work on the multi-items inventory modelling and joint replenishment. But the research on the inventory modelling for multi-generational products is still rare. Although there have been many models that have been built to ascertain the demand pattern of technology products. But very limited work has been done on the inventory modelling for technology products that come in generations.

Since the studies on the inventory optimization research in the domain of technology generations are rare to be found, this study intends to develop the EOQ Models for the inventory replenishment of technology products. Also, this study tries to explore the implications of trade credits, storage space constraints, price-dependent demand and imprecise business environment on the inventory decisions for technology generation products. Price, trade credits and storage space are the strategic levers for the managers dealing in technology generations to influence the demand of the products and therefore to drive the business in the desired direction. But the research work in this direction is rare.

Therefore, this thesis is going to formulate the appropriate demand model for technology generations, validate it on an existing dataset on the diffusion rate of technology generation products, and then, use it for inventory modelling and optimization under different practical scenarios.

To begin with, the extensive search of the literature was carried out on the popular research databases: Springer, Wiley, Scopus, Science Direct, Jstor, Absco, Web of Science. In order to ensure the quality, this study covers the review of the research papers mostly published in reputed Scopus-indexed or ABDC rated journals. First, the detailed review was done on the diffusion of innovation products so that the diffusion dynamics of technology products could be understood better and given due consideration in the review of inventory models. Post this, the review was carried out on the inventory modelling for the technology generations. The review discovered that the research that has been done on the inventory optimization of multi generation technology products is not only rare but also very restrictive in its scope and assumptions. The study then proposed the gaps in the existing literature, which were taken up for further research.

The five research objectives were defined, and each of them were addressed one by one by developing appropriate demand model and inventory model; and illustrating it numerically. Most of these models were highly non-linear in nature and could not give a closed form solution, but gave fairly good solution. Important theorems were also derived and special cases were looked upon for each of the models. The managerial insights were derived to help the industry practitioners in their challenge of managing inventories for technology products.