

**THE VALUE OF CONSIGNMENT STOCK AND VENDOR-MANAGED  
INVENTORY BEYOND INFORMATION SHARING**

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**THE VALUE OF CONSIGNMENT STOCK AND VENDOR-MANAGED  
INVENTORY BEYOND INFORMATION SHARING**

by

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## **CERTIFICATE**

The thesis entitled ‘The value of consignment stock and vendor-managed inventory beyond information sharing’, being submitted by Mr. Devendra Choudhary to the Indian Institute of Technology Delhi, for the award of the degree of Doctor of Philosophy (Ph. D.) is a record of *bona fide* research work carried out by him. He has worked under my guidance and supervision and has fulfilled the requirements for submission of this thesis, which has attained the standard required for Ph. D. degree of this institute. The results presented in this thesis have not been submitted in part or in full to any other university or institute for award of any degree or diploma.

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## ABSTRACT

In recent times, new forms of retailer-supplier partnership (RSP) have evolved in order to reduce system inventory and provide maximum value to the end-customers. RSP encompasses three distinct components – information sharing, shift in inventory ownership and shift in decision making responsibility from the downstream retailers to the upstream suppliers. Thus, RSP; as a concept, is a continuum where the level of collaboration increases from one end to another end of this continuum.

The value of information sharing (IS) is well recognized in the literature and practicing world due to the fact that it mostly generates benefits to the supply chain partners. For a fair distribution of the benefits between the suppliers and retailers through IS and to motivate the retailers to do so, there is a relationship known as retailer-managed consignment inventory (RMCI) in which the inventory is still managed by the retailers while owned by the upstream suppliers. It is expected that the retailers would gain by moving from IS to RMCI because they do not incur the opportunity cost of inventory tied up in the downstream of the supply chain. However, how RMCI would benefit the suppliers and system as a whole is less clear. Even more, the benefits of the centralized system may not be realized using IS or RMCI due to independent decision making and focus on local optimization of each partner without considering the impact of its decisions on the performance of others. Due to this fact, partnering companies involved in a supply chain have to enhance their level of collaboration. One of such collaborative initiatives is vendor-managed inventory (VMI).

In VMI, the suppliers have the access to the retailers' demand and inventory data and they are responsible for generating orders and maintaining the inventory plan on behalf of the retailers. A VMI initiative may or may not involve consignment inventory. When the suppliers retain ownership of the inventory at the retailers' location along with the

responsibility of managing it, then it is called vendor-managed consignment inventory (VMCI). Thus, a VMI relationship consists of two distinct key components – information sharing and shift in decision making responsibility from the downstream retailers to the upstream suppliers. Whereas, the third distinct component under VMCI is a shift in inventory ownership (i.e., consignment inventory).

This study aims to investigate whether, when and how aspects of VMI and RMCI are superior to IS considering replenishment-related strategies, product-related features and operational level system parameters. This study is carried out because prior research and industry reports posit differing accounts on the effectiveness of RMCI and VMI beyond IS. The adoption of VMI requires a high degree of trust and behavioural integrity to overcome implementation difficulties, which is not the case under IS and RMCI. Thereby, moving beyond IS/RMCI is only justifiable when incremental benefits offered by VMI are significantly higher than the tangible and intangible investments required in implementing and adopting it.

One major theme in the evolving inventory management theory is to incorporate more realistic assumptions about product demand into inventory models. Distinguishing the incremental value offered by RMCI or VMI beyond IS is a difficult task, and there have been a few attempts to do so under continuous or stationary stochastic demand conditions. Nowadays, however, many companies are experiencing not only non-stationary demand, but the uncertainty also changes because of seasonality, trends, customer buying patterns, or other factors. Even more, companies are introducing new products at a higher frequency due to shorter life cycles.

We develop analytical models to quantify and analyse dependent performance measures in a two-echelon serial supply chain under non-stationary deterministic and stochastic demand

conditions. Particularly under non-stationary stochastic demand, the models are proposed to compute the value offered by VMI over IS considering “static uncertainty” and “static-dynamic uncertainty” strategies with cycle service-level and cycle fill rate constraints. Further, a detailed computational study is carried out using a test data set involving a variety of product-related features and operational-level system parameters. Further, experimental results are analysed and compared to figure out the magnitude of the incremental value in terms of cost savings, inventory reductions and increase in inventory turns using RMCI or VMI above and beyond IS.

The study provides guidelines relevant to academia and supply chain practitioners in taking VMI or RMCI adoption decision beyond IS according to their specific business environment. It also identifies the business environment in which VMCI can be used as a means to make VMI a viable option for downstream retailers by distributing economic benefits equitably.

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