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Int. J. Production Economics 81–82 (2003) 215–224

international journal of
production
economics

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The consignment stock of inventories: industrial case and performance analysis

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Abstract

The "Consignment Stock" technique is a novel approach to the management of inventories in supply chains. It is based on an improved collaboration between the company and its suppliers, one that is acquiring growing importance in industrial environments, as the authors have found in Italy. The main aim of the present work is to describe the technique itself, thus underlining its potential benefits and pitfalls. The case proposed refers to a company manufacturing components for the automotive industry. Essentially, the company offered its suppliers the opportunity of stocking part of the items in its own warehouses, with the agreement that they would guarantee over time an inventory level between a set minimum and a maximum value.

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Keywords: Supply chain; Inventory management; Consignment stock

1. Introduction and consignment stock practice

There is no question that over the past decades an increasing amount of research has concerned the importance of establishing a profitable vertical relationship between companies and suppliers, especially in management literature. In particular, strong interaction and reliable collaboration between these two actors have emerged as strategic issues and powerful instruments for maintaining or acquiring competitive advantages in a dynamic and selective market. Indisputably, this issue also plays a pivotal role in inventory policies and management. Yet, despite the growing number of studies and theoretical models developed, the operational research still seems to be frequently divorced from industrial reality. Meanwhile, several practices that are not dealt with in the literature show up, acquire importance, and prove to be successful.

This is the case of consignment stock (CS) management of provisioning, which, regardless of some similarities with the common (s, S) policy, reveals significant innovative contributions. Nowadays, this practice has been widely adopted in Italy, and is consistently gaining consensus among both small and large firms. Both business press and private sources have also confirmed recent CS applications between Italy and other countries. Under a CS policy, the relationship

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PII: S0925-5273(02)00300-6

between a company and a supplier is based on the following simple rules:

1. The supplier will guarantee the company the continuity of an available stock between a minimum level s and a maximum level S: the stock will be stored in the company's raw material depots, close to the production lines.
2. The company may draw on raw materials daily, according to its needs. The supplier is paid for these materials according to their agreement, hypothetically up to a daily frequency, so that the information concerning the consumption trend is also constantly refreshed and immediately transferred to the supplier.

In such a way, the continuous replenishment from the supplier protects the company against demand fluctuations and costs determined by eventual stockout may also be debited to the supplier, by means of contract penalties. On the other hand, the supplier has a better perception of his customer's requirements: lower stocking costs are incurred and the continuous evolution of market demand is directly perceived thanks to an electronic data interchange (EDI) interface. Several benefits are immediately evident:

1. The company always has raw material available.
2. The company pays for raw material consumption only when the items are drawn on for use.
3. The supplier saves holding costs and may organise his production in different ways, also with respect to eventual third parties.
4. A renewed and reinforced link is set up between the company and its supplier.

However, CS requires the accurate definition of various parameters, i.e. s and S, and a constant attention to the information flow, that is, the electronic transmission to the supplier of item consumption. On this basis, the supplier can foresee the consequences of a better management of his own production, being freed from the bounds implicit in the strict EOQ practice (e.g. handling large but infrequent orders).

This paper seeks to provide a coherent framework within which to understand the success of CS. We ask why these changes are taking place. Is it a mere coincidence that various firms are adopting CS policies or is there a rationale behind their choice? If this is the case, how should their choice be implemented?

So as to grasp both the *why* and the *how* of CS, the rest of the paper is organised as follows. Section 2 briefly presents the main results of the literature, while Section 3, using the results of a computational simulation, shows how CS policy may outperform previous models. In other words, we provide a tentative proof that CS is a *rational* choice. Section 4 addresses the main tactical questions that follow the decision to adopt CS. This problem is tackled with the benefit of insights offered by a case study. Concluding remarks follow.

2. Literature review

One of the major outcomes of the inventory theory has been to show that (s, S) policies are optimal for a class of dynamic inventory models with random periodic demands and fixed ordering costs. Under a common (s, S) policy, if the inventory level at the beginning of a period is lower than the reorder point s, then a sufficient quantity must be ordered to achieve an inventory level S. Literature on the subject is ample and covers a wide time span. E.g., Iglehart (1963) obtained the stationary distribution of the inventory/backlog and developed an explicit formula for evaluating the stationary average cost, with the appropriate assumptions. Zheng (1991) has provided a rigorous proof of the optimality of an (s, S) policy for the model of Veinott and Wagner (1965). Sethi and Cheng (1997) broadened some previously rigid assumptions in favour of more realism, and still demonstrated the optimality of (s, S) policies dealing with a given distribution of demand.

In general, many practical inventory replenishment problems satisfy reasonably well the mathematical conditions under which this type of policy is convenient; however, complex analytical methods for computing the best (or even "a good") policy are rarely used, because, according to some practitioners, they are prohibitively expensive.

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