COMPARATIVE STUDY OF DIFFERENT FORMS OF MATERIAL PROCUREMENT WITH RESPECT TO THE LOGISTIC AND PURCHASING ACTIVITIES OF THE MANUFACTURING COMPANY

Marián Sedliak[1], Marián Šulgan[2]

Summary: The contribution brings an insight into the different forms of material procurement. It compares so-called traditional approach of procurement with Just-in-Time and Just-in-Sequence approaches and points out main characteristics of each system with respect to logistic and purchasing activities.

Keywords: material procurement, inbound logistics, purchase, Just-in-Time, Just-in-Sequence

INTRODUCTION

The term "procurement" can be interpreted in various ways. For the purpose of this contribution we will consider "procurement" as a process which includes purchasing, transportation and all the other logistic activities related to receiving inbound material from outside organisations, in other words all the activities which contribute to the assurance of demanded material items for fluent production process (we consider manufacturing company as a purchaser). Basically, there are two different approaches to manage enterprise procurement. There are systems which work under so-called "push principle" and systems using "pull principle".

Within the push systems, also called Make-to-Stock systems, the movement of the products and information is based on long term forecast demand. On the other hand pull principle means that movement of the items is carried out only if the next stage of the supply chain requires them; therefore it is often called Make-to-Order system.

Supply chains often use both principles, the push principle at the beginning and the pull principle at the last stages of the supply chain. The main reasons are obvious – the increasing trend toward the mass customisation and the fact that with the increase of the product value during its downstream movement the inventory carrying cost rises as well. The place where the push system changes into pull system is called customer order decoupling point.

In the article, we compare three procurement forms (PFs):

- form labelled as traditional procurement approach because it is based on the push principle which is the older one,
- Just-in-Time (JIT) procurement,

[1] Ing. Marián Sedliak, University of Žilina, Faculty of Operation and Economics of Transport and Communications, Department of Road and Urban Transport, Univerzitná 8215/1, 010 26 Žilina; Tel.: +421 41 513 3523, E-mail: marian.sedliak@fpedas.uniza.sk

[2] prof. Ing. Marián Šulgan, PhD., University of Žilina, Faculty of Operation and Economics of Transport and Communications, Department of Road and Urban Transport, Univerzitná 8215/1, 010 26 Žilina; Tel.: +421 41 513 3506, E-mail: marian.sulgan@fpedas.uniza.sk

- Just-in-Sequence (JIS) procurement.

Although the last two PFs work both on the pull principle, the differences in their organising and operation are obvious. The basic features of each PF are described in the next section.

1. DESCRIPTION OF PARTICULAR MATERIAL PROCUREMENT FORMS

Each of the procurement forms occurs in several alternatives. Hence description of the optional possibilities is appropriate as a first step.

1.1 Traditional procurement

Since we mentioned that traditional PF works under push principle, which is based on long term forecast demand, holding of inventories in such system is certain. There are two basic inventory management systems within traditional procurement (2):

- Fixed-order-quantity system and
- Fixed-time-period system.

As the name suggests, the amount of material in each delivery within fixed-order-quantity system is constant whereas time interval between deliveries varies depending on the actual consumption of material. An order is placed when inventory on hand reaches a predetermined minimum level (reorder point) necessary to satisfy demand during the order cycle. The inventory level in the system has to be continuously monitored. Consequently the requirements for technical and information support of inventory management increase. Order quantity can be determined by optimizing the total cost function, which includes ordering cost and inventory carrying cost. The optimized order quantity is labelled as “economic order quantity”.

Under fixed-time-period approach, inventory level is reviewed at a certain, set time interval. An order is placed for a variable amount of inventory, whatever is required to get the company back to its desired inventory level. This approach is common where many items are purchased from the same supplier (3).

1.2 Just-in-Time procurement

This form of procurement was developed by automobile manufacturers (OEMs). Nowadays also suppliers of OEMs often use this system within their own inbound logistics and some companies from other industries employ it too. JIT also occurs in a few modifications. The common feature of all is that one delivery of material items (components, parts) covers usually only the several hours need of production. This significantly reduces the raw-materials inventories and increases the requirements for accurate and frequent transport.

According to Gregor and Košturiak (1), following basic modifications of JIT occur:

- JIT in the block,
- JIT in the mix,
- JIT in the sequence.

In the first case the preparation of components is carried out according to the different type series. Gathering of a certain amount of parts can be realized near to the point of consumption – it means near manufacturer's plant (de-groupage, transfer to smaller palettes, etc.), near the supplier (direct production into the means of transport) or between the two places.

In the second case different modifications of the same parts are placed separately in the same transport unit and then they are transported to the manufacturer. This is used if purchasing firm requires more items from one supplier in the same time.

JIT in the sequence is equivalent to the JIS system which is described in the next subsection.

1.3 Just-in-Sequence procurement

As we have implied, JIS is a modification of JIT system. But this modification is crucial hence this system is currently labelled as a separate one – JIS – which is also used mainly within automotive industry, especially between OEMs and their first tier suppliers. Suppliers under JIS regulate their own production plans so as to be able to deliver their products at the right time, in the right quantity, at the right place, and ***in a specific order - the sequence*** (7).

Need for such system was caused by the increasing variability of incoming material items (operational units and modules) as a consequence of mass customization of the final product. Within JIS the customer's order usually involves the detailed specifications of the required final product (hence also specification of particular components and modules). The information is transformed into the production plan which determines the order of vehicle production. Information for suppliers is generated automatically in the form of sequential impulses, which are also automatically sent usually via electronic data interchange (EDI). Sequential impulses define the sequence in which modules should be delivered and are usually sent to the supplier a few days before the assembly of the final product.

In view of the common supply operation, it is possible to conduct the process of sequencing in two basic forms (7):

- Supplier delivers components under JIT to a location near or within the final assembly plant, the components are from this place sequenced to the assembly line,
- Supplier delivers pre-sequenced items directly to the assembly line.

In the first case, complex services of third party logistics providers (3PLs) or lead logistics providers are often used. In addition to transportation they perform the sequential warehouse operation including the process of sequencing. After receiving the sequential list from the client, the 3PL repackages the products in the correct order in the special containers, which must be on time and again in the correct order sent to the assembly line.

In the second case, supplier inserts components to the special containers in accordance with required sequence, and then these containers are also placed to semi-trailer with respect to the order. At defined time the supplier delivers the consignment, stops the semi-trailer vehicle at the concrete place of unloading and assembly line is supplied directly from the

semi-trailer. After emptying the trailer, it is filled with empty containers which are delivered back to the supplier.

2. DIFFERENT CHARACTERISTICS OF PARTICULAR PROCUREMENT FORMS WITH RESPECT TO THE LOGISTIC AND PURCHASING ACTIVITIES

This section provides an overview and summarisation of particular PFs' features. It does not address the issue of determining the appropriate PF for a concrete material item. Basic assumptions for the item's classification can be found in the contribution labelled in references as (8).

Operation of every manufacturing company consists of many logistic activities. The following subsection will focus on the description of the key activities of inbound logistics and their characteristics within particular PFs.

2.1 Comparison of procurement forms with respect to the logistic activities

Table 1 depicts differences between particular PFs with respect to chosen criteria within activities of inbound logistics area. We can observe that in the warehousing area there is a trend toward decrease of inventory level (JIT, JIS), hence the likelihood of dead stocks' generating decreases too and so material obsolescence occurs rarely. One can also observe that the fixed-order-quantity system involves lower inventories, if we compare it with fixed-time-period system. It is given by way of reviewing inventory level (system observes inventory level continuously). Although fixed-time-period system has fewer demands on management it has also the potential of maintaining excess inventories and it is more susceptible to inventory shortages.

In the area of material handling is an important criterion so-called "number of touch points". This measure represents an effort needed to assure required sequence of material inputs before production (it involves all handling activities from material receipt by purchaser's plant).

Criteria like accuracy and frequency of delivery and the distance between the supplier and the customer's manufacturing plant are crucial in the transportation area, especially for demand driven systems (JIT, JIS).

Considering the accuracy that is required for delivery under JIT and JIS and relevance of adverse impacts arising from its breach, it is obvious that the whole process must be supported by an efficient information system. It is advantageous to use systems based on a modular structure that allow individual processes (represented by the modules) to be modified, replaced, relocated or create entirely new processes (7). Especially within JIS relatively high demands are placed on the supplier's information system (see criterion IT requirements).

Tab. 1 – Differences between traditional procurement form, JIT and JIS procurement with respect to the logistic activities

Logistic activity	Criterion	Traditional approach		JIT	JIS
		fixed-time-period system	fixed-order-quantity system		
Warehousing and inventory management	Maximal inventory level	High/Sometimes redundant	Mediate	Low	Very low
	Safety stocks level	Sufficient/Sometimes inefficient	Sufficient	Inefficient	Highly inefficient
	Maximal inventory level coverage	Weeks/Days		Hours	Hours/Minutes
	Material obsolescence	More possible	Low likelihood	Very low likelihood	
Material handling	Number of touch points	High		Mediate	Minimal
Transportation	Frequency	Low		High	Very high
	Accuracy	Minor significance		High	Very high
	Suggested supplier's allocation	Minor significance		Near purchaser's plant	In the neighbourhood of purchaser's plant
Packaging	Transportation units	Standardized		Standardized / Specialized	Specialized
Logistic communication	IT system requirements	Standard		Standard/ Integrated	Fully integrated
	Stability of sequence	Irrelevant		Irrelevant	Absolutely necessity
	Downturn reaction times	Days		Days/Hours	Hours/Minutes

Source: authors

2.2 Comparison of procurement forms with respect to the purchasing activities

Table 2 contains comparison of the PFs with regard to assurance of purchasing activities.

Tab. 2 – Differences between assurance of purchasing activities within traditional procurement form and within JIT and JIS procurement

Purchasing activity	Traditional approach	Just-in-time	Just-in-sequence
Choosing supplier	Two or more suppliers, key choosing criteria is price	Often only one supplier who has to be able to assure frequent and accurate deliveries	Often only one supplier who has to be able to assure deliveries in required sequence
Placing an order	The order determines delivery time and quality	Framework agreement, deliveries are made as necessary	
Changes in orders	Delivery time and quality are often changed at the last moment	Delivery time and quality are fixed, quantity can be adjusted within predetermined range according to the current need	Delivery time and quality are fixed, in case of unexpected situation the order of parts has to be changed according to the new sequence
Subsequent order control	Lot of telephone calls, necessity to solve difficulties with deliveries	Few difficulties with deliveries due to clear agreements, discrepancy in quality or delivery time is not accepted	
Control of received deliveries	Quality and quantity control of all deliveries	Sample checks at the beginning, later there are not necessary any other controls	Controls are not necessary
Supplier evaluating	Quality evaluation, delivery deviations up to 10 % are accepted	Deviations are not accepted, price is fixed and it is based on clear calculation	
Invoicing	Payment after each delivery	Invoices are gathered, payment usually once a month	

Source: (4), edited by authors

In the area of purchase, we can see that traditional procurement form prefers multi-sourcing model, where the price is the key criterion for supplier choosing. On the contrary, JIT and JIS systems prefer orientation on a single supplier. The supplier has to ensure high quality of products because there is no time for subsequent delivery control within customer's manufacturing plant.

CONCLUSION

The contribution deals with features and differences of typical circumstances in operation of each PF involved. As procurement includes logistic and purchasing activities, both were considered. Differences in logistics were reviewed through a set of chosen criteria within key logistic activities. The main differences pertain to the area of warehousing and inventory management (the inventory level) and the transportation (frequency and accuracy). Also logistic communication requires certain changes within particular PFs (different IT system requirements of parties involved, downturn reaction times). The purchasing area differs mainly in way of choosing supplier, order placing, control activities and invoicing.

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