



# Management of purchase process in realization of building investment

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## Abstract

In building companies process of product and service purchase is one of the main processes of quality management system [1]. Because of short time-limits of contract realization, high specialization of works, necessity of fulfillment of high quality requirements and assurance of profitable financial effects the management of purchase process becomes very important element of work of the building company. The serious problem in creating and keeping the efficient system of purchase management is special type of purchase in building companies. Particular investments are realized in different country regions, objects are built based on the individual design documentations and each building becomes independent organization unit that organize purchase necessary for investment realization.

An example of the management system of purchase process in building company is described in the paper. Just In Time system is widely used during the realization of building investment. This system is especially useful in buildings because some investments, especially in big cities, are characterized by restriction in building site. This makes impossible storing the products. In such cases close synchronization between times of delivery and requirements of purchase schedule and schedule of building realization is very important. Criteria of supplier selection as well as the methods of choosing the supplier are also presented in the paper. Special attention is paid to necessity of valuation of the purchase efficiency and the purchase risk. Basic coefficients of purchase efficiency are also described in the paper.

**Keywords:** quality management, purchase, supplier

## 1. Introduction

Building industry is the part of economy where significant changes in management process can be observed. Extreme competition on the market of investment contractors causes that building companies are forced to introduce the efficient management of purchase process. Well planned and controlled purchase process supported by computer systems may decide about the contract results.

Well planning of the process realization and good control of this process should assure investment realization in the time settled in the contract as well as fulfillment of quality

requirements specified in the contract and technical specification and achievement of planned contract margin.

Monitoring of purchase process should enable to make analysis and valuation of the process and take corrective and improving actions. This monitoring includes control of supply quality, valuation of risk connected with the choice of suppliers, punctuality of products delivery and proper products quality and also analysis of efficiency. Obtainment of planned aims is not possible without choosing the right suppliers and cooperation with them in the process of contract realization. Developing good relationships with suppliers and permanent seeking alternative sources of delivery as well as careful contract negotiations with suppliers are very important elements of building company policy.

## 2. Purchase planning

Efficient management of building investment realization requires the use of adequate methods and instruments of planning and monitoring of the process. In case of realization of building investment the contract schedule, connected with the cost calculation, design documentation and the technical specification, is the effective instrument of planning and monitoring of the process. This contract schedule defines the right order and dates of execution of individual operation as well as the type and quantity of resources (people, materials, devices, equipment, costs) necessary for contract realization.

More and more often for the schedule preparation computer systems connected with the cost calculation programs are used. The computer systems enable to create tasks necessary for realization of separate investment stages considering resources and their updating. For each task the lifetime, correlation with other tasks and possible limitations can be introduced.

Experiences show that efficient management of products and service purchase has the great influence for the quality, punctuality and costs of investment realization.

The diagram of creation of factual-finance planning documents of investment realization is presented in fig. 1.

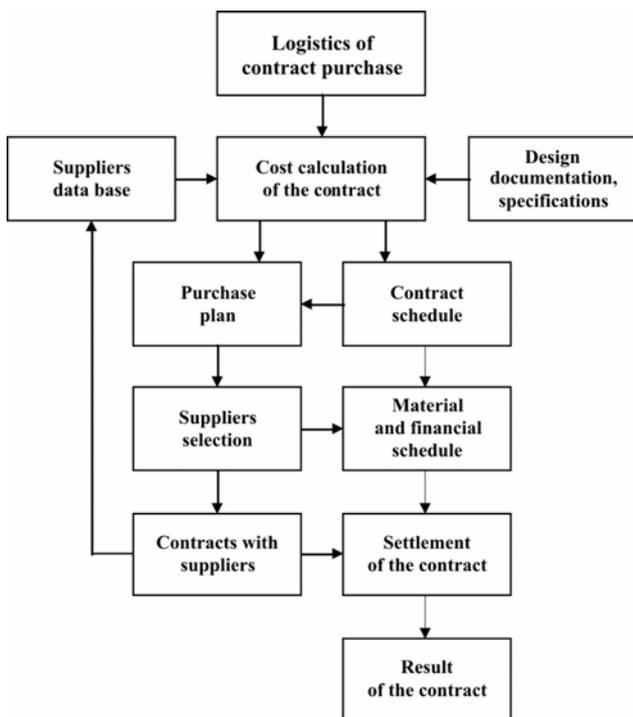


Fig. 1. The diagram of factual-finance plan of investment realization

The cost calculation of the investment is created based on database information about suppliers (costs, experiences from the former cooperation), experiences from the other investment realizations, design documentation and technical specification. The investment schedule is worked out based on the records from the contract with the customer and on the resources described in

the cost calculation. Based on the cost calculation and the contract schedule the computer system generates the purchasing schedule.

This schedule should take into account the following:

- quantity and type of ordered products,
- suppliers,
- delivery schedule,
- technical parameters of products,
- financial requirements of purchasing,
- type of transport.

The purchase process worked out based on the contract schedule enables to introduce the Just In Time system. The essence of this system is to deliver the product exactly at that time, when it is needed and applied for the production. As a result we can obtain savings from reduction or even elimination of stock-in-trade and from lack of storing costs. This system enables also to implement a better financial policy of the building company.

The Just In Time system demands the accurate compliance with the purchase schedule and the high efficiency and reliability of the following logistical system: building site – supplier – products carrier. It is demanded from the suppliers that the products respond the requirements described by the technical specifications and are supplied exactly in time and in correct quantity.

Introduction the Just In Time system is possible only during the good partnership cooperation with suppliers, that expected from the customer:

- long-term cooperation,
- adequate anticipation of fixing time of supplies,
- correct technical specifications,
- quick payment dates.

## 3. Elements of purchase logistics

Fundamental element of logistics of products purchase are:

- defining the number of suppliers,
- defining the optimum distance between the supplier and the building site,
- defining the cost policy,
- selection of the suppliers.

Great number of suppliers limit the risk of lack in time of particular product but at the same time increase the costs of purchase system and deprive the orderer of taking advantage of the effect of scale purchase during the cost negotiations. It is profitable to choose the suppliers located nearby the building site and the chain suppliers.

Product purchase includes the following elements:

- the purchase type,
- the purchase form,
- the purchase conditions,
- suppliers selection,
- methods of products delivery to the building site.

The purchase type includes:

- the class of product and its technical parameters,
- quality requirements,
- type of documents confirming the products quality.

The purchase form includes:

- products quantity,
- the size of batch of supply,
- the schedule of delivery of each batch.

The purchase conditions include:

- procedure of ordering the product,
- negotiations of purchase conditions,
- cost and payment conditions,
- defining the place of supply,
- defining the communication rules,
- rules of supply complaint.

Suppliers selection includes:

- qualifying of the suppliers,
- sending the question offer,
- the optimum offer selection,
- assessment of cooperation with the supplier.

## 4. Criteria of supplier selection

For assurance the optimum price of the purchase together with the quality defined in technical specifications the choice from minimum three suppliers is demanded.

During the supplier selection the following criteria are taken into consideration:

- **quality**: ability to satisfy by the suppliers the customer requirements relating to the technical parameters,
- **price**: supplier susceptibility for the price negotiations, discounts, payment conditions,
- **supplier reliability**: punctuality of supply realization, assurance of traceability identification, reaction on defects and nonconformities, openness for making corrects in the contract,
- **supplier capability**: production capacity, technical skills, equipment and devices secured supplies realization in demanded time,
- **financial condition**: financial status of supplier should be stable and secure supplies realization and the warranty service,
- **supplier location**: regional suppliers have the possibility of realization urgent orders and enable the closer cooperation.

The supplier choice can be made by the point method (Claus method) or by the graphic and point method.

Using the point method the following should be settled:

- basic criteria of supplier choice as well as the properties describing the particular criteria,
- the point scale,
- possible coefficients describing importance of the property and its influence for the purchase process.

The choice of the supplier is made by the comparison of the point valuation of different suppliers.

The graphic and point method enables to visualize the criteria of the supplier choice on the base of the parameters of the point method. Table 1 shows the supplier valuation based on the point method.

Table 1.

The point method of the supplier choice

No.	Subject of qualification	Point valuation		
		Number of points	Multiplier	Total points
1.	Products quality	0 - 5	4	
2.	Warranty time	0 - 5	2	
3.	Price level with reference to the competition	0 - 5	4	
4.	Payment conditions	0 - 5	3	
5.	Price reductions, discounts	0 - 5	3	
6.	Openness for order correction	0 - 5	2	
7.	Punctuality of delivery	0 - 5	4	
8.	Own transport	0 - 5	1	
9.	Warranty service	0 - 5	3	
Total				

## 5. Products ordering and receipt

The next stage of activity connected with the purchase process is ordering and receipt of products. The essential actions connected with the ordering of products are:

- defining the type and quantity of the order,
- defining the quantity of the single batch of products,
- defining the time of delivery and the order confirmation for the particular products described in the purchase schedule,
- defining the fixed-date of supply realization according to the requirements of contract realization schedule,
- defining the rules of quality control and quantity and assortment control of the delivery,
- defining the rules of making complaint and return the product,
- defining the communication methods with the suppliers including the order delivery and confirmation, information about the expedition of particular batch of products.

Many issues can be solved in simplify procedures in case of permanent suppliers connected with the firm by long-term partnership business cooperation. In these cases verified procedures exist and enable considerable improvement of purchase process.

Because during the time of investment realization the very popular and common is the Just In Time system, the special requirements are demanded to the process of ordering the products. Orders should be made ahead of and in appointed time. It enable to delivery the product exactly in time specify in the schedule of process realization. It is necessary to settle times of delivery with the supplier with regard to time of the transport and reloading works.

## 6. Preliminary test of purchase

The purchased products are identified by the documents (shipment specifications, delivery documents) and subjected to the preliminary test. This preliminary test includes:

- checking the completeness of delivery,
- checking documents of delivery, attests, quality certificates, conformity statements,
- checking the conformability of technical parameters of products and making tests and laboratory researches if it is required by the subject codes.

In farther part of this work preliminary test of concrete and steel are shortly presented. These materials have significant importance for the quality and the financial result of the investment.

### 6.1. Preliminary test of concrete

The quality control of delivery is made for designed and reciped concrete according to PN-EN 206-1 code [3]. Specification of concrete delivery should contain information in fig. 2. Delivering each load of the concrete mixture to the building site, the concrete producer should present the delivery proof which includes:

- the name of the concrete factory,
- the delivery number,
- the registration number of the car,
- date and time of loading in the concrete factory and the amount of concrete mixture,
- time of concrete delivery to the building site and time of beginning and finishing unloading.

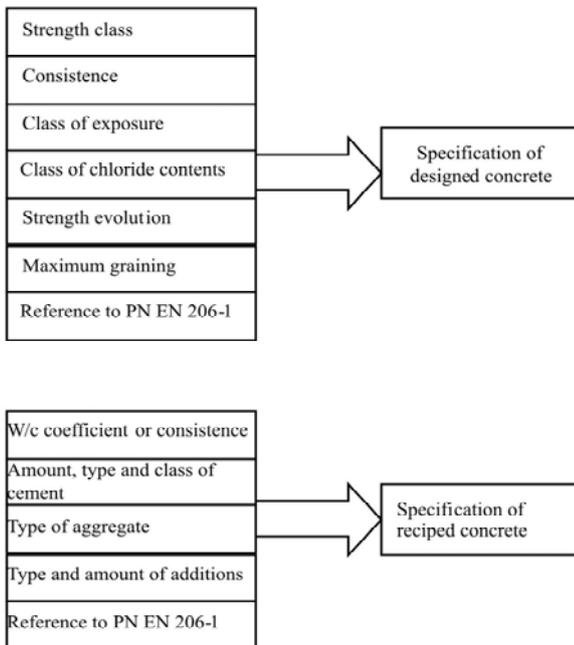


Fig. 2. Specification of concrete quality

## 6.2. Preliminary test of metallurgic products

Preliminary test of delivery of metallurgic product includes:

- checking the completeness of delivery,
- checking the delivery documents,
- identification of metallurgic products with the delivery documents,
- visual control and random control of thickness and shape of delivery.

This control is made on the base of PN-H-04420:1988 code [4]. Completeness of delivery is checked by comparison of the type and the quantity of metallurgic products with the order. Checking the delivery documents shows whether the records in these documents are consistent with the order and the type and quantity of the delivery. Identification of metallurgic products includes checking conformability of identification marks on the metallurgic products with the records in the delivery documents. The code settles also rules of drawing of samples and admissible deviations of measurement of metallurgic products.

## 7. Valuation of purchase efficiency

Efficiency of purchase process is studied with reference to the individual purchase and to the purchase realized for the needs of the whole investment. It is also possible to value purchase efficiency for the whole concern.

Basic coefficients of purchase efficiency are presented below:

1. Efficiency of supplier choice for the individual delivery. This efficiency is calculated for the single item of purchase schedule.

$$\text{Coefficient 1} = \frac{\text{Value of the offer of selected product}}{\text{Value of planned budget for this product}}$$

2. Efficiency of supplier choice for the purchase made within the whole investment

$$\text{Coefficient 2} = \frac{\text{Value of the offer of chosen suppliers}}{\text{Value of the budget of these contracts}}$$

3. Theoretical efficiency of supplier choice for the individual purchase

$$\text{Coefficient 3} = \frac{\text{Value of the optimal offer}^1 \text{ of individual purchase}}{\text{Value of the budget planned for this purchase item}}$$

4. Theoretical efficiency of supplier choice for the purchase made in the investment

$$\text{Coefficient 4} = \frac{\text{Value of the optimal offer}^1 \text{ of purchase}}{\text{Value of the purchase budget}}$$

<sup>1)</sup>Optimal offer – minimum value of individual offer item from the whole considered offer

In companies with the quality management system according to the PN-EN ISO 9001:2009 code the special, processing approach is used. This approach is based on the process management with regard to connections between these processes. The code binds the companies to permanent improvement of the processes on the base of objective standards. In table 2 examples of coefficients for analysis and valuation of purchase process are shown.

Table 2.  
Coefficients for the purchase process.

No.	Type of standard	Formula	Value
1.	lacks in the supplies	piece/delivery	
2.	delays of supplies	%	
3.	total time of delay	hours/days	
4.	participation of complaints of products quantity and type	%	
5.	participation of complaints of products quality	%	
6.	efficiency of complaints	%	
7.	complaints value	PLN	

Valuation of purchase efficiency makes possible to take actions for improvement of the purchase process through undertaking corrective and preventive actions. These actions intend to identify the reason of nonconformity, settle the reason of the cause and undertake actions that prevent rising such nonconformity in the future. The actions refer to nonconformities in the purchase process and also to nonconformities stated during the valuation of purchase efficiency.

## 8. Valuation of purchase risk

The most often the risk is valued when probability of the project result is estimated. The building investment consists of many different processes and each of them can finish with the success or the fail. One of the most important processes connected with the investment process is the purchase process. Considering its importance for the result of the contract the analysis of purchase risk should be made before starting the contract realization. There are some typical actions connected with the risk management:

- acceptance – in case of risk of minor importance, low probability of appearance and low effects. This type of risk is accepted and no actions is taken,
- protection – taking preventive actions through assurance alternative suppliers, making corrections in design documentations, the right suppliers selection,
- reduction – taking actions that lessen probability of appearing the risk or limit the results of the risk.

The first step in the risk management is identification of the risk factors. These risk factors can be divided into two groups:

- external – independent on the company,
- internal – dependent on the company.

External risk factors of the investment purchase:

- fluctuation of the market conditions,
- difficulty with getting the finances,
- changes of market conditions for the product used for the

- investment realization,
- changes in design documentation,
- changes in the law system,
- conformability with the requirements of natural environment.

Internal risk factors of the investment purchase:

- design errors,
- the wrong strategy in cooperation with the suppliers,
- the wrong calculation of purchase cost,
- errors in orders and delivery times,
- choice of inappropriate supplier,
- errors in purchase schedule,
- unsuitable supervision over the purchase process.

The next stage is valuation of significance of risk of particular factors in the purchase process and estimation the probability of their appearance and degree of risk detectability. Estimation of these factors is not easy because they refer to the future, often single, unprecedented actions. It is why they are difficult for analytical description. In tables 3 - 5 examples of actions connected with the risk management are shown.

Table 3.  
Risk valuation considering probability of risk appearance (P)

points	description
2	low probability of appearance
4	medium probability of appearance
6	high probability of appearance
10	almost certain appearance

Table 4.  
Risk valuation considering the significance degree (S)

points	degree	description
1	low	insignificant influence for the schedule and the budget
2	medium	limited influence for the schedule and the budget
4	high	high influence for the schedule and the budget
8	very high	high influence for the schedule and the budget that unable the realization according to the contract

Table 5.  
Degree of risk detectability (D)

points	detectability
10	low detectability
8	medium detectability
4	high detectability
2	very high detectability

Based on the coefficients defined according to table 3 - 5 the value of the risk coefficient can be calculated according to the formula  $RPN = P \times S \times D$ . In the result of the risk valuation the plan of the risk management can be prepared according to table 6.

Table 6.  
Plan of the risk management

Risk factor	Description of the action	Responsible

## 9. Conclusions

Process of product purchase aiming at realization of the building investment should take into account the following aspects:

1. Purchase planning should be made based on the schedule of contract realization considering the cost calculation. This process should be supported by the computer systems.
2. The choice of product suppliers should take into consideration ability of suppliers for fulfillment the quality requirements with the optimal cost. Periodic control of cooperation with the suppliers should be made.

3. Valuation of purchase efficiency should be made to introduce corrective actions and constant improve of purchase process.
4. Before starting realization of the purchase valuation of risk connected with the purchase should be made as well as the actions for minimization this risk should be taken.

## Literature:

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