



EFFECTIVE MANUFACTURING LAYOUT AS A CONDITION OF ECONOMY OF PRODUCTION

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Abstract: *At a time when there is a competitive struggle among manufacturing companies, important aspects to consider are quality, speed and efficiency of processes in the production system. This paper describes the interactions within the life cycle of the product applied to the design of production systems, resp. manufacturing layout. Emphasis is placed on the pre-production phase, where the design of the spatial arrangement of the production system can be most influenced*

Key words: *layout, production system, process, economy*

1. INTRODUCTION

In today's turbulent environment, where supply exceeds demand, a manufacturing company must seek competitive advantages. Customer requests the shortest delivery time, at the lowest price and the required quality. This can be achieved in various ways. One way is to focus on the spatial arrangement of the production system. The spatial arrangement of the production system and deployment of machinery determines the non-technological operations proceeding in the production system (Havelka, 2000). Therefore a suitable design of the manufacturing layout is a very important point. In this paper we describe the possibility of optimizing the manufacturing layout in relationship to the constructional-technological design of the product. Furthermore, we can efficiently design both non-technological and technological processes, which are indispensable for running the production system.

Technological operations - these are operations that are carried out by mechanical or human labour, including the preparation of production and other activities, without which we cannot obtain the final effects from the sale of the product.

Non-technological operations - also called 'logistic operations', such as moving, control, storage etc. These operations do not increase the value created for the customer, but in the context of the production process they support the efficiency of the technological operations. (Srajer et al., 2010).

Put simply, we can say that if we want to establish an efficient production system, we have to set the technological and non-technological operations in order to respect the important links between products, processes of production and the manufacturing system. These three entities are strongly connected and are essential for the design of the system.

2. DESIGN OF MANUFACTURING LAYOUT

Design of manufacturing layout affects a large number of influences. When designing a manufacturing system, resp. manufacturing layout, a very important role is played depending on if we perform the optimization or expansion of the production range in the existing production system or implement a brand new project (a completely new design of manufacturing system or building). If we optimize an existing production system we have to consider certain restrictive conditions, e.g. the existing machinery, dimensions of the

building, the location of input and output space, layout of power distribution, lighting, etc.

Other significant aspects during the design of the manufacturing layout are:

Requirements of the market- if a manufacturing company wants to be competitive it must react flexibly to market requirements. It must be able to produce the desired products to the desired quality and at the asking price. Therefore a thorough market analysis is the cornerstone for the design of the production system.

Product assortment together with the number of products designate the type of production - one-piece production, serial or mass production.

Type of production - based on information about the type of production it is possible to design a rough draft of the manufacturing layout. As shown in Fig 2 process layout will be most advantageous for piece production; cell layout for serial production, and product layout for mass production. (Gregor et al., 2000).

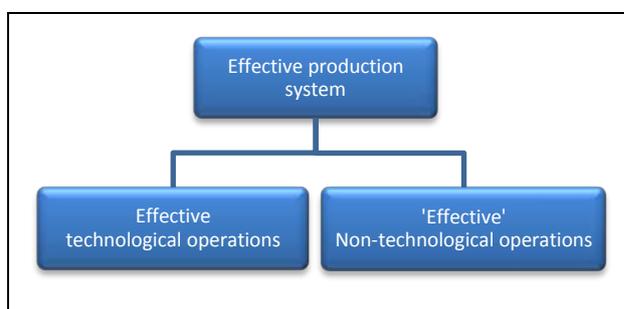


Fig. 1 Effective production system

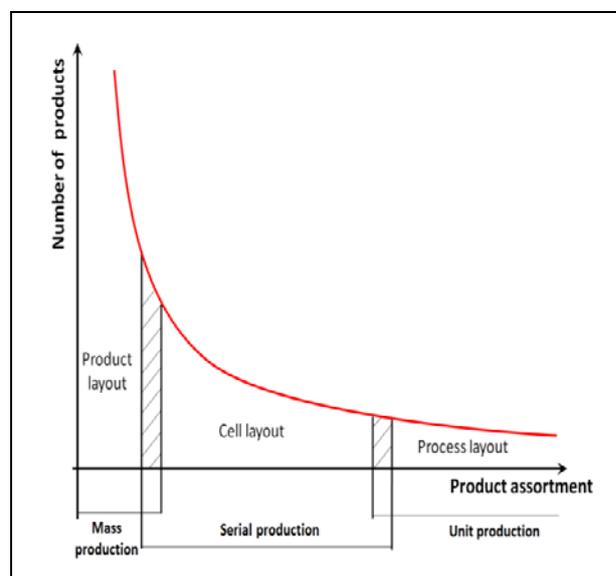


Fig. 2 P-Q diagram

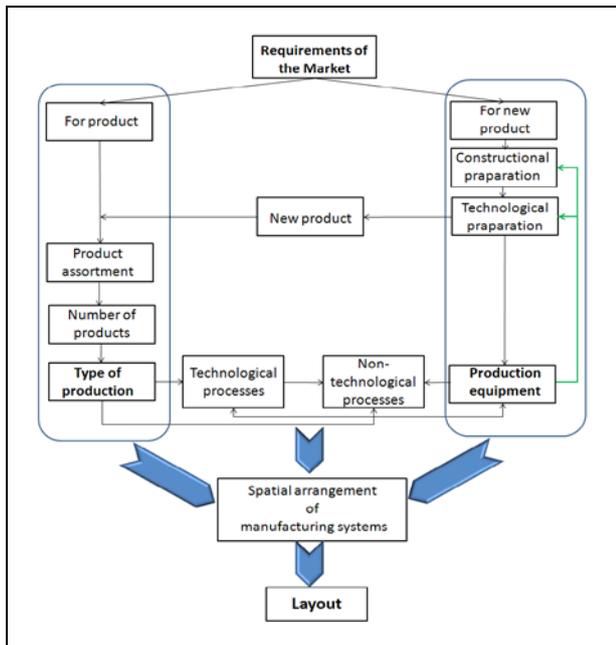


Fig. 3 Design of manufacturing layout

Constructional-technological design of the product has a significant impact on the entire production system. The product is designed based on customer requirements, respectively market requirements. The product must fulfil the criteria characterizing its properties, such as: material, shape and dimensional accuracy, functionality, reliability, etc. for which the customer is willing to pay, and also desired profit. The concept of the new product must not exceed the costs, which are based on the previous criteria. The next step is design of technology and assembly. In this phase the system designer selects the machines, production equipment, tools and designs technology operations, respectively non-technological operations. This phase has a very significant impact on the entire production system. The resulting effects in the form of the final product can be achieved in a number of different modes of production. Each production technology has specific technological operations that determine product quality, production time, costs for these technological operations, etc.

For example, production of holes. It is possible to create holes using a number of different technologies such as:

- drilling,
- turning,
- milling,
- waterjet,
- laser,
- etc.

Each of these methods has its specific features that determine the technological process of production. These specifics affect the entire production system, respectively the spatial arrangement of the production system. These specifics include time-consumption of preparation, production time, tools, quality, as well as preparatory operations, related operations (grinding, etc.), etc.

One variant should be chosen from all the variants. This variant provides effective setting of the production system. This variant should fulfil the technological conditions in synergy with the requirements of spatial arrangement of the production system. If we want to design a production system to be the most efficient and to compete with other competitive production systems, we must choose the appropriate mix of technologies used in the production system.

Some of the production systems are designed so that the production technology ensures the "lowest" cost for production.

However, they do not consider the strong influence of costs related to the spatial arrangement of the production system. These production technologies can, despite low production costs, mean higher costs for non-technological operations (costs associated with the manufacturing layout), which increases overall costs. When choosing a technology we must take into account the strong relationship among technological, non-technological operations and spatial arrangement, which affects the efficiency of the entire production system. The selected production technology must also fulfil other specific criteria for an effective production system. An integral part of the changes to technology and resources to ensure the production process is the need to fulfil requirements for product properties. If a change to the technology also changed the properties of the product, it is necessary to verify whether the change will affect the applicability of the product. If so, it is necessary to change the technology so that all requirements are fulfilled.

3. CONCLUSION

Technological and non-technological processes within the production system are dependent on the type of production and constructional-technological design of the product (see Fig. 3). The type of production determines in the primary phase which spatial arrangement of the production system will be most advantageous for the production: for piece production - process layout, for serial production - cell layout, for mass production - product layout.

Another very important area affecting the production system, respectively spatial arrangement of the production system, is the constructional-technological design of the product. To achieve an efficient and economical setting of the production system with regard to the spatial arrangement of the production system it is necessary to focus on the constructional-technological design of the product and, last but not least, on the chosen means of handling.

In the future, we would like to develop this approach to production system design in more detail and to try to apply it in practice.

4. ACKNOWLEDGEMENTS

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