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## LOGISTICS AND PRODUCTION PROCESSES TODAY AND TOMORROW

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**Abstract:** The production process consists of activities that are required in transforming an input set to valuable outputs. Input set includes human resources, raw materials, components, equipments, energy, money, information, etc. Market globalization, increasing global competition, and more complex products result in application of new production and logistics technologies, methods and business processes. Fast changing market environment and fluctuating customer demands require efficient operation of production and logistics processes. In this study the intermitted and continuous production processes are introduced. The essence of Industry 4.0 conception is also detailed.

### 1 Introduction

Production systems are those activities of a manufacturing company, where resources flowing in a defined system, which resources are combined and transformed based on logic to add value.

Logistics is a common word nowadays, since it is an essential component in supply chains and also in the competition of the economic operators.

Therefore, the goal of logistics is to provide things in adequate quality and quantity at a given destination, in an appropriate time, from an appropriate origin, with an appropriate method and equipment, and with an appropriate minimal cost.

The quality and availability of the offered services by the logistics sector are of capital importance for the economical growth and for increasing employment potentials.

Globalization, enhanced competition in the global market, more complex products with shorter lifecycle and fluctuating customer demands gave rise to new technologies, business processes and the application of global supply chains. Therefore, the logistic sector is currently meeting and will meet in the future new practical challenges, and the fast respond to them is the key of success for the economic operators.

### 2 Introduction of the development objectives in global production and logistics

The production and logistic goals are originated from general corporate goals, of which maximal customer satisfaction is one of the most important. Actually all the other goals can be derived from this, which are listed in the following paragraph (logistic goals are underlined) [1-4].

With shorter lead time the customer would get the ordered product in the shortest time possible. Economical

and profitable corporate operation can be achieved by utilizing the maximal production (or service) and logistic capacities, which includes the optimal utilization of human sources and equipments. Flexible production (or service) and logistics is needed to answer the demands of the rapidly changing economics and dynamic customer demands. The development of business processes can be realized only by high transparency and by the continuous monitoring of the efficiency of the systems, since which process can be measured is can be improved.

Ensuring and enhancing the quality of the processes is of priority for customer complacence. Nowadays sustainability and the use of environmental-friendly materials and technologies are also defined as a goal, as well as green waste management and recycling. In terms of cost reduction the main goal is to decrease stocks and to operate production and service processes efficiently throughout the whole supply chain and at each individual party in the supply chain. The optimal construction of the global, intercontinental supply chains can also be an element for success in competitiveness.

### 3 Today's production processes

Production is an organized activity which has an objective, which is to transform various inputs to useful outputs.

Production processes can be divided into two categories [5, 6]:

- Made to stock (Push) production processes (traditional mass production), and
- Made to order (Pull) production processes (production of unique products).

The traditional mass production is replaced by unique production (or smaller batches), or from the philosophical point of view the 'Push' approach is replaced by 'Pull' approach.

In case of push philosophy production planning is based of forecasted data (not actual customer demand), so that the result is high amount of products, including unsalable stock is created. On the contrary, the uniqueness of production with pull philosophy lies in the fact, that production starts only when an actual customer demand

appears (with detailed specification), which starts acquisition and manufacturing processes.

Production processes can be divided into two categories in aspect of continuity (Figure 1) [5, 6]:

- Intermitted production systems, and
- Continuous production systems.

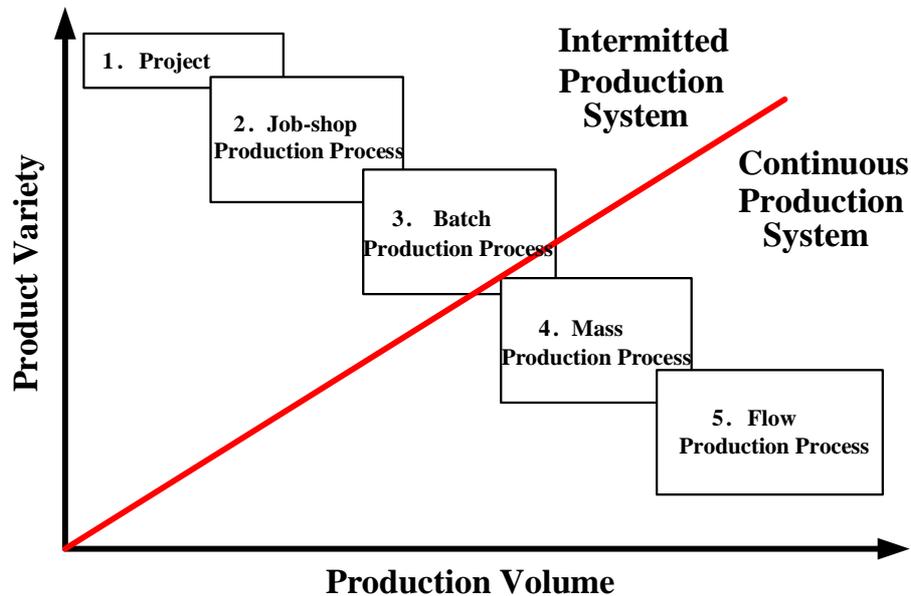


Figure 1 Types of Production Processes

### 3.1 Intermitted production systems

General characteristics of the intermittent production are the followings:

- production system is flexible,
- design of the product can be changed flexible,
- general purpose machines and equipment are used,
- production is not continuous,
- volume of the production is small,
- product variety can be high.

#### 1. Project production

Main characteristics of the project production are the followings: the production is a complex process, low volume, high customization, the sequence of operations is unique to each project/product, fixed position layout.

#### 2. Job-shop production

Main characteristics of the job-shop production are the followings: manufacturing of one or few quantity of products, low volume and high variety of products, general-purpose machines arranged into different departments, each job requires unique technological requirements and machines, requires highly skilled operators and high inventories.

#### 3. Batch production

Batch means a single production run, the batch size means the quantity produced in a single production run (may be less than 100 units or up to a few 1000 units).

Main characteristics of the batch production are the followings: shorter production runs, plant and machinery are flexible, manufacturing lead time and costs are lower compared to job-shop production.

### 3.2 Continuous production systems

General characteristics of the continuous production are the followings:

- process flow is a predetermined sequence of operations,
- production system is not flexible,
- design of the product can not be changed flexible,
- production is mostly continuous,
- volume of the production is high,
- product variety can be small.

#### 1. Mass production

Mass production is a manufacturing process of discrete parts using a continuous process.

Main characteristics of the mass production are the followings: manufacturing of small variety (mostly only one) and huge volume of products, machines are arranged in a line or product layout, product and process sequence are standardized, cycle time of the production is short, low inventory, balanced production lines, high productivity.

## **2. Flow/Process production**

Flow production is characterized by the manufacturing of a single product. The flexibility of this kind of plants is almost zero. Only one type of product can be produced.

Main characteristics of the flow production are the followings: manufacturing of small variety (mostly only one) and huge volume of products, special purpose machines in a fix sequence, manufacturing cycle time is zero.

## **4 Tomorrow's production processes – Industry 4.0 conception**

The tendencies of the 21st century – such as the s life-cycles of products are shorter while consumers demand more complex, unique products in larger quantities – poses many challenges to the production.

There are many sings that show that the current practices in the utilization of resources is not sustainable, which will limit the production.

The industrial sector is going through a paradigm shift, which will change the production drastically. The traditional centrally controlled and monitored processes will be replaced by decentralized control, which is built on the self-regulating ability of products and workpieces that communicate with each other.

The essence of Industry 4.0 conception is the introduction of network-linked intelligent systems, which realize self-regulating production: people, machines, equipments and products will communicate to one another.

This paradigm shift includes the conception of Industry 4.0, which is widely used in Europe, especially in Germany. The name of the conception forecasts the upcoming 4th industrial revolution, because according to the theory of the conception the 1st industrial revolution introduced automation, the 2nd mass production, the 3rd is the utilization of robots. Industry 4.0 will bring intelligent production robots.

The goal of the conception is to make flexible, custom production economical, and to use resources efficiently. It requires each equipment that takes part in the production to communicate with one another. The organization of information flow is executed by a central production control system.

Products control their own production, since to communicate with unique product codes with the machines and equipments, which mean virtual and actual reality merges together during the production. The scheduling of the production will be also controlled by the communicating products. Factories will be self-regulating and optimize their own operation. [7, 8]

### **4.1 The 5 main components of networked production**

The 5 main elements of the networked production can be defined by the following [9]:

1. digital workpieces,
2. intelligent machines,
3. vertical network connection,
4. horizontal network connection,
5. smart workpieces.

#### **1. Digital workpieces**

The dimensions, quality requirements and the order of technological processing is given for the digital workpieces.

#### **2. Intelligent machine**

Intelligent machines communicate simultaneously with the production control system and the workpiece under processing, so that the machine coordinates, control and optimize itself.

#### **3. Vertical network connection**

When processing the unique specifications given by the customer for the product to be manufactured the production control system forwards the digital workpiece created by automated rules to the equipments. The products control their own manufacturing process, since they communicate with the equipments, devices and the other workpieces about the conditions of the production.

#### **4. Horizontal network connection**

The communication is realized not only within one factory, but also in the whole supply chain; between the suppliers, manufacturers and service providers. The main purpose is to enhance the efficiency of production and to utilize the resources in a more economical way.

#### **5. Smart workpiece**

The product to be manufactured senses the production environment with internal sensors and controls and monitors its own production process in order to meet the production standards, since it is able to communicate with the equipments as well as the components already incorporated and to be incorporated.

### **4.2 The main technologies of Industry 4.0**

The importance of production arranged in global network is that the manufacturing process can flexibly adapt to the unique costumer demands, to the activity of the other parties of the supply chain and to the rapidly changing economic environment.

The term Industry 4.0 is getting global recognition and the survey of PWC [10] from 2016 defines three main areas, where it affects the corporate world:

- integration and digitalization of horizontal and vertical value chains
- digitalization of products and services,
- the formation of digital business model and costumer relations

This framework and the connected new technologies are shown in Figure 2.



Figure 2 The main technologies of Industry 4.0 [11]

The production technology of Industry 4.0 is not a technology from the far-away future. In July 2015 the Changing Precision Technology (Dongguan, China) became the first factory where only robots work. Each labour process is executed by machines: the production is done by computer operated robots, the transport is implemented by self-driven vehicles and even the storage process is completely automatic.

According to experts there is 20-30% growth potential in intelligent production networks, and the companies that refuse to follow the development and modernization will fall behind in the global competition. In the near future companies will become digital corporations, which will allow them to realize custom production with maximum efficiency according to the costumers' demands. The prior condition for this is to allow every equipment, device, workpiece to communicate with each other. Although in the near future human resource will still remain the key and essential factor in production.

## Conclusions

Globalization, changing economic environment and customers' demands and the ever increasing competition in the market emerged the need for new manufacturing technologies and business processes. These changes constantly confront the practice of logistic with new challenges. This study describes the recently used general production and logistics aims and processes.

The industrial sector is going through a paradigm shift, which will change the production drastically. The

traditional centrally controlled and monitored processes will be replaced by decentralized control, which is built on the self-regulating ability of products and workpieces that communicate with each other.

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### **Review process**

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