

PRODUCT FLEXIBILITY MODEL AND PRACTICE OF MANUFACTURING PLANTS

Summary

The principal objective of this thesis is to present, in theoretical, cognitive and practical terms, the issues related to product flexibility of a manufacturing plant. The intention of the authors remains conducting literature enquiry with regard to the paradigm of a flexible manufacturing plant, determination of the relation of resources and flexibility of a manufacturing plant, referring the resource-based model of a flexible manufacturing plant to the business practice. When conducting an analysis of the specific nature of the resource-based model of the flexibility management system, by presenting the main conditions having impact on it, the authors will suggest recommendations in this respect. For practitioners of management they might be the basis for diagnosis and an inspiration for preparing the strategy of its implementation.

Key words: product flexibility, manufacturing plants, farm machines

MODEL ELASTYCZNOŚCI PRODUKTOWEJ A PRAKTYKA ZAKŁADÓW WYTWÓRCZYCH

Streszczenie

Dokonując analizy specyfiki modelu zasobowego systemu zarządzania elastycznością, przedstawiając główne uwarunkowania mające na nią wpływ, w niniejszym opracowaniu autorzy dokonują kwerendy literatury w zakresie paradygmatu elastycznego zakładu wytwórczego, określają relacje: zasoby a elastyczność zakładu wytwórczego, jak również odnoszą model elastycznego zakładu wytwórczego do praktyki gospodarczej – ocena możliwości zasobowych producenta i na tej podstawie modelowanie zasobów w procesie implementacji zawieszania przyczepy rolniczej.

Słowa kluczowe: elastyczność produktu, zakłady wytwórcze, maszyny rolnicze

1. Introduction

Manufacturing plants of the farm machines' sector, operating in Poland, in order to compete effectively with foreign companies intensively and expansively entering our market, with a strong and well established position, should intentionally and flexibly shape their approach to the changing conditions and the market needs [5].

In view of the foregoing, in the opinion of the authors of this publications, significant importance may be attributed to the ability to adapt and adjust the possessed tangible, financial, human or information resources. Resources and their possession, and actually the access to them, are of a critical importance for flexible behaviours of an organization [2].

This is discussed in this article, which has the nature of a creative synthesis, based, on the one hand, on a detailed analysis of the problem theory, and, on the other hand - on past own research of the authors.

The purpose of further discussions is to prepare a methodology for assessment of resource possibilities of a manufacturer and, on this basis, modelling resources in the process of implementing suspension of an agricultural trailer.

2. Research assumptions

The research mentioned in this study was conducted in the Production Plant of Spare Parts and Farm Machines, which is located in Września (Wielkopolskie Province). The main form of operations of the examined company is

the production process of modern machines for agriculture, their subassemblies and spare parts.

On the basis of the analysis of documentation (material data sheet, technological drawing, assembly documentation) and on the basis of the guided interview with the manager of a production plant, (responsible for implementation processes), and as a result of observation of the participant, the authors have obtained information necessary, for the research.

The subject of research was the process of implementation of a new product i.e. suspension of an agricultural trailer (Fig. 1), used as a spare part or a component in the machine production process. In order to facilitate the information flow between different people, the authors have suggested using a specific part symbol, giving it number 203910200.

3. Modelling resources necessary in the process of implementation of the suspension of an agricultural trailer

Data obtained as a result of observation confirm the preliminary assumptions of the authors of the study, according to which the material and personal factors (knowledge engineers) affect the product flexibility of a manufacturing plant. Use of worn-out machines, lack of specific knowledge resource, application of improper or low-quality (inconsistent with specification) raw material, tools or technology make it impossible to achieve a flexible implementation process.

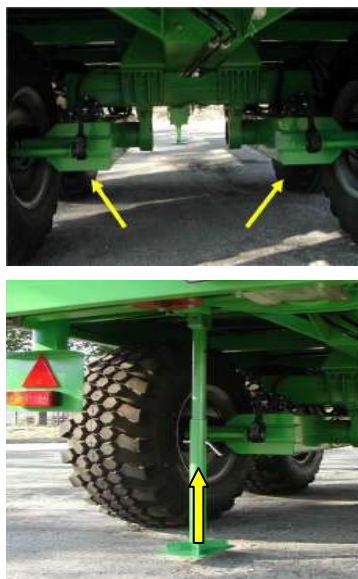


Fig. 1. Implemented mounting of an agricultural trailer [3]

In the process of implementing the suspension of an agricultural trailer, modelled for the needs of this study (tab. 1), it is necessary to use appropriate raw material (column A) in the quantity indicated (column C and D) whose purchases is a specific cost for the manufacturer (column F).

In a given production process, an indispensable thing is performance of specific machining operations (tab. 3) (column H), therefore, the manufacturer has to dispose of appropriate machinery (column G), equipped in particular tools, instruments (column I). Technology, understood as science or field of knowledge on methods of processing of raw materials, materials and objects, as well as methods of manufacturing ready-made products and on machines, devices and tools used for processing and manufacturing, is determined by the raw material, its intended use and operational properties, therefore, its continuous improvement and use in a given manufacturing plant become indispensable.

Table 1. Objects of work and financial resources in the process of implementation of the mounting of an agricultural trailer

Part no. 203910200		Part name <i>Mounting</i>		Intended use Agricultural trailer	
OBJECTS OF WORK				FINANCIAL RESOURCES	
Material	Size/PCS. (mm)	Number /PCS. (pcs.)	Weight/PCS. (kg)	Raw material purchase price (PLN)	TOTAL (PLN)
A	B	C	D	E	F
Steel sheet	1250x450x6	1	27	2.31/kg	62.37
Steel sheet	300x65x6	4	0.94	2.31/kg	8.69
Steel sheet	300x200x5	2	2.4	2.31/kg	11.09
Steel sheet	200x30x5	4	0.24	2.31/kg	2.22
Rolled bar fi-120	L-20	2	1.78	2.89/kg	10.29
Pipe 159x17.5	L-450	1	-	290.00/m.b.	130.50
Pipe 127x16	L-385	1	-	171.00/m.b.	65.84
Square bar 90x90	L-700	2	44.52	3.17/kg	282.26
Pipe 36x4	L-500	2	-	12.5/m.b.	12.50
COSTS OF RAW MATERIAL (PLN):					585.76

Source: own study on the basis of the research

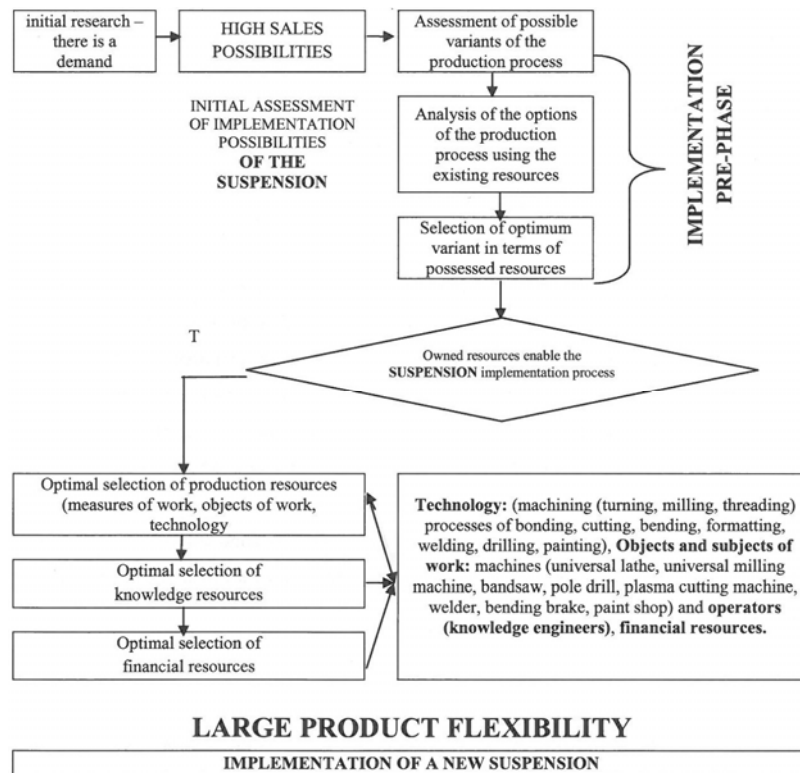
Tab. 2. Measures of work, technology and financial resources in the process of implementation of the mounting of an agricultural trailer

Part no. 203910200		Part name <i>Mounting</i>		Intended use Agricultural trailer	
MEASURES OF WORK/technology				FINANCIAL RESOURCES	
Measure of work	Type of operation	Additional equipment		Cost of work (PLN)/pc.	
G	H	I		J	
Universal lathe	Turning	-		27,80	
Universal milling machine	Milling	-		5,30	
Bandsaw	Cutting	-		2,00	
Pole drill	Drilling	-		1,00	
Plasma cutting machine	Burning	-		20,00	
Welding machine	Welding	-		20,00	
Bending brake	Bending	-		2,00	
Paint shop	Painting	-		2,00	
				LABOR COSTS¹ (PLN):	80,10
				OTHER COSTS² (PLN):	64,08
				TOTAL COSTS (tab. 1 -F)+ (Tab. 2 - J) (PLN):	729,94

Source: own study on the basis of the research

¹ They are designated for a particular specifications of materials necessary to manufacture a given product unit.

² The presented cost group includes costs of special tools, costs of energy, depreciation, taxes and fees, social insurance and other benefits, as well as other costs, such as cost of business travels or costs of representation. When calculating these costs, the basic formula is used, in accordance with which: **Other costs = labour costs x 80%**.



Source: prepared by the author

Fig. 2. Assessment of product flexibility of the examined manufacturing plant

4. Assessment of product flexibility of the manufacturing plant – own research results

In the process of implementing suspension of an agricultural trailer, modelled for the purpose of this study, the manufacturing plant in which observations were conducted, has subjective and objective factors that enable it to use only its own resources (Fig. 3). It enables substantial reduction of costs of implementation of the product, shortening its time, which, especially in the agricultural sector, has tremendous importance owing to the seasonality of purchases³. When making a decision on implementation of the suspension of an agricultural trailer, criterion under which decisions are undertaken by the manufacturer are: necessary objects of work (tab. 2) and work measures and technology (tab. 3), as well as financial resources and knowledge resources for each of these areas.

As it has been many times emphasized in this study, each plant or factory is a manufacturing system. Its material and personal elements are used for performing various manufacturing processes. In order to implement a new product, it has to be taken into account that the gathered resources of the production system may be different than resources necessary for implementation of the manufacturing process – the company is no longer flexible, i.e. reconfiguration and integration of the manufacturing process do not create possibilities for implementation of the finished product.

A modern manufacturing plant discussed in the study has extensive machinery (which has been confirmed by

documentation analyses and observations of the authors), which covers e.g.: lathes, milling machines, bending brakes, cutters for cutting metal sheets, bandsaws, welders, drills, grinders, slotting machines, broaching machines, benders, hydraulic and mechanical presses, plasma cutting machines and other objects of work offering a broad range of production possibilities, unique technology and a competent personnel (knowledge engineers), which, according to the criteria adopted in the paper, proves its high product flexibility.

5. References

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³ Excessively long, non-flexible implementation process may generate additional costs being a symptom of wastage. If the manufacturer does not implement a product at a relevant time, sometimes, he/she must wait for selling it from even a year. This is the case with parts and harvest machines, for which the annual demand lasts not longer than for 1 month.