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DEVELOPMENT OF PRODUCTION LOGISTICS SYSTEM BASED ON LEAN PRINCIPLES

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ABSTRACT: *This paper acquaints the production logistics system about a Hungarian operating vehicle part manufacturing company, including its examination, and development opportunities. This paper's highlighted objectives are the preparation and analysis of the basic data of development recommendation. Moreover, it demonstrates lean based outsourcing strategies which could significantly reduce the company's handling demands. We examined several aspects of the above questions and suggestions and the underlying test results are presented in the following points. Our goal is to form a user-based logistics outsourcing strategy. It can be found in the literature how a complex, comprehensive decision making model can be created using outsourcing strategies.*
KEYWORDS: *lean, outsourcing strategies, logistics system, make or buy*

INTRODUCTION

This research basically helps to make a „make or buy" decision, because at the company described in this paper, it is essential to make a continuous service and development for the applied extruding, welding, hole punching, embossing and milling processes.

Notably it is true for the milling machines, which average age exceeds 20 years, and there are no possibilities to extend their lifespan with additional service and repair. It is important to decide, whether it is worth buying new machines, or there is a safe outsourcing strategy, that would not threaten the quality of the end item and unreasonable supplies will be avoidable.

We examined several aspects of the above questions and suggestions and the underlying test results are presented in the following points. Our goal is to form a user-based logistics outsourcing strategy. It can be found in the literature how a complex, comprehensive decision making model can be created using outsourcing strategies.

BASIC THEORETICAL BACKGROUND. Lean approach

Lean is a business organization or business management approach that aims to make companies more successful and the production of products and services economical. The method is most widespread in the industry, such as the Toyota Production System which forms the basis. The main objective is to increase the efficiency of work processes by eliminating or minimizing the losses. There are two main rules in the lean:

- *Respect for people*
- *Removing the not value-creating steps from the processes or activities.*

It is only considered as value what is important for the customer, the customer pays for it and meets the customer's demands. "In the process' aspect, the customer is defined all the people (clients, customers), or the other business process, or another company (buyer), which uses the product of a process (whether it's a real product or service)." [8]

Lean manufacturing system is determined as follows:

- *"Systematic approach to identify and eliminate the losses (non-value added activities) based on the customer extraction of the constant improvement of the production process, striving for perfection." [9]*
- *There is an approach to the introduction of heavy company, which has been also formulated in the following excerpts of the book Lean Machines [8].*
- *"Depends on the people. Therefore it's so difficult. To get people to change - to do things differently as they used to - it's very, very difficult." (Art Byrne, Wiremold's CEO)*
- *"If a company truly committed to the Lean, you have two or three years in kindergarten before you reach the first grade level. This shows how difficult it is." (Mark DeLuzio, architect of the Danaher Business System, Danaher)*

According to other papers [10] the Lean's productivity tools are simple, easy to introduce and have spectacular results in the cost and loss reduction. Today's trendy Lean courses teach business

philosophy, and beyond that the strategy, which also have an impact on the results as it changes the organization and co-operation through the organizational culture change.

Outsourcing business models

The outsourcing process requires large discretion, with many economic, managerial and organization theory approaches. Application of these models can help us to make an outsourcing strategy, which can determine the recommended range of products and outsourced technologies for outsourcing. The well-known outsourcing business models:

***The agent-theory**. The agent theory focuses on the principal-agent encountered problems of conflicts of interest during contracting. The problems come from information asymmetry between the two parties, the different goals and from the different degrees of risk running. Since the agent may have different objectives from those of the client, as well as more familiar with the task, he has the opportunities to maximize their own benefit in the transaction.*

The principal can protect himself against the agent's opportunistic behavior in three ways.

The first one: control systems are made by the conclusion of contracts, which are able to monitor the progress of the task, so the lack of information will decrease.

The second one: encouraging the agent, so that they can bring their goals closer, therefore the other party will not provide their own goods with the service

The third one is to form directive conduct standards, which are fixed in the contracts and directly govern the behavior of the agent in each situation. The agent-theory is to examine the relative costs of these three methods.

In the case of outsourcing, we can also speak about principal and agent who carry out the task they are charged with. It is essential to decide about the reduction of information asymmetry or appearance against the opportunistic behavior of the agent, which is the most cost-efficient solution for the company.

***Porter's value chain concept**. A company is trying to meet the customers' needs with its products and services. Essentially the company's aim is to make value for consumers. The value chain development was created by Michael Porter.*

The concept is based on the recognition that a company is able to work effectively if it is aware of the importance of key processes and it could increase the value of its products and services. The company's breakdown to strategically important agents is to help make the cost aggregation factors clear. If within the company one of the value-making operations was entrusted to an external provider for cost reduction reasons, outsourcing may be a good solution.

***Hamel & Prahalad's organizational basic abilities model**. The model's key is the company's basic ability to distinguish itself from its competitors. The basic capabilities are built into the basic product that is the part of the final product. The theory states that the basic organizational skills and basic activities associated activities should not be outsourced because they are carriers of the long-term competitiveness. Therefore, the basic skills should be revealed, and it is essential to provide them with proper resource supply and development, even if it involves some degree of centralization. According to Hamel and Prahalad, the activities in connection with the company's basic abilities and the basic functionality should not be outsourced, they should be centralized. The reason is that the company's service may be vulnerable, and competitiveness may be impaired.*

***Williamson's transaction cost theory**. Williamson's transaction cost model reflects widely accepted views. The theory is that economic transactions can be created in two ways. The first solution through the organizational hierarchy, the second is the market solution.*

According to Williamson, company have to choose outsourcing if the service is not special, if the number of potential suppliers is high, surrounded by a secured environment, and the company not too often have resort of that. To avoid the high costs of coordination special attention must be paid to the design and preparation of the contact.

***Pfeffer's power-political model**. The sources of organizational power are the position and access to the critical resources. These can be obtained with different political tactics, such as defining decision-making criteria, selective use of information, use of external experts or step for a coalition or cooperation. According to Pfeffer, the outsourcing decisions have non-economic (Williamson), or strategic (Hamel and Prahalad) basement. The decisions cannot be predicted in advance, but they might be understood. According to Pfeffer outsourcing decisions are created by political strategies and tactics. The decision process is not free from conflicts of power within the organization. The outsourcing decision can change the original distribution of power, so those in power are trying to develop their own interests according to the decision making process. Counterparts do the same. Moreover, the potential external providers can join in the power-political battles.*

LOGISTICS OUTSOURCING MODEL

To develop the business model, Hamel and Prahalad organizational basic abilities model proved to be the most appropriate, and the basis for our research. In fact, we had to meet two different principles to understand the company's activities. In particular, we need to establish what the basic

actions (extruding) are to avoid outsourcing, because they are the carriers of the company's long-term competitiveness. After that, at the analysis of the outsourced activities (cutting) a cost-benefit analysis had to be done to help us to avoid the additional costs associated with grown logistics activities. Thus, the decision-making process based on the logistics services is built into the product. The objective is to minimize these activities. Because of the milling manufacturing processes the cost price, the external lease-work, the logistic costs will increase, it deteriorates the company's competitiveness so it has become necessary to reconsider the outsourcing of certain machining operations.

TECHNOLOGIC BASIC TYPES

The factors increasing production cost are as follows:

- *A significant part of cutting machines are obsolete, the usage in this state are costly*
- *Due to insular of the cutting plant there is significantly more demand for handling*

The change in product portfolio requires new operational layout planning because of the changed object dependencies, handling benchmarks.

Technologic basic types modeling

As a result of the technology studies in the plant seven basic technology paths can be observed:

1. *No manufacturing on the cooperation products*
2. *The raw material is cut and / or milled*
3. *The raw material is cut and / or pressed*
4. *The raw material is cut and / or milled, can be pressed*
5. *The raw material is cut and / or pressed, can be milled*
6. *Firstly, the machining is made with own technology, and then on the pieces an outside contractor performs a job, and then transports them back to the plant to work on with own technology.*
7. *Rarely, the relatively less product related technology is the etching, which is often repeated within the technological route.*

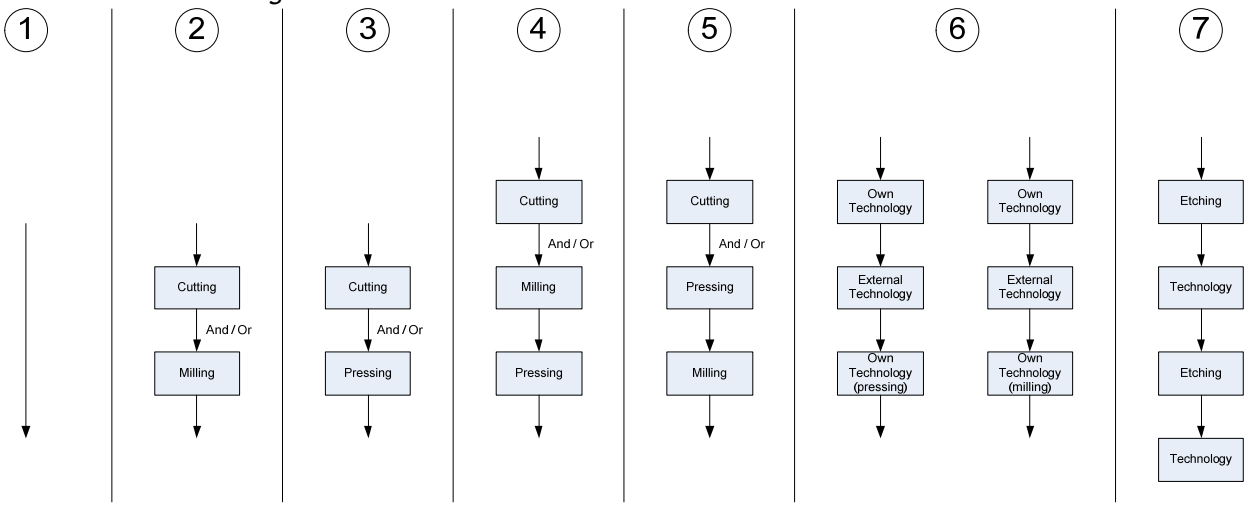

Figure 1 – Technological basic types modeling

Table 1 – Steps of outsourcing

	Aspects of Outsourcing	*Aspects of Insourcing*
Step 1:	*What are the basic materials of the cooperative products - Are currently being outsourced*	
Step 2:	*Before cooperation machining are outsourced Steps after cooperation to be outsourced if they are not pressing.*	*Products supplied after cooperation, machined by pressing will remain.*
Step 3:	*Just step cutting and / or machining containing products (and the products contained in their BOM) to outsource.*	
Step 4:		*Just step cutting and / or products that require pressing riding (not cooperative) will remain.*
Step 5:	*Before pressing step, goods produced with milling type machining are outsourced until the first pressing.*	*Finished product that needs pressing and milling that does not need cooperation articles. Articles built in these finished products have got a flag, if they are not outsourced due to other reasons.*
Step 6:	*Products selected by the company's experts got "outsourced" flag According to the changed technological environment products are categorized again.*	*Products selected by the company's experts got "stay" flag According to the changed technological environment products are categorized again.*

Logic of outsourcing

The primary principle is to keep core competencies within the company. The core competencies are the following:

- *Cutting and pressing operation requiring a greater investment in technology, so they are strategic activities,*
- *Such operations that is difficult and costly to be performed outside the company.*

During outsourcing it is worthwhile to rank the peripheral competencies according to priority, such as other competencies like milling, and related logistics activities. The reasons for this are:

- *Milling machines need renovation,*
- *Milling operation on the market is cost-effectively available,*
- *Less counts strategic activity.*

Outsourcing of milling activity is recommended if the before and after operations do not belong to the core competencies.

Technology paths examination

In the plant 7 core technology paths can be observed:

1. *The co-operative products are obviously not being tested, since they have been outsourced.*
2. *When in the technological pathway working processes are present only concerning the peripheral competence, e.g. the raw material is not only squeezed then cut and / or chipped, then the product's technology path can be fully outsourced.*
3. *When the raw material is only cut and/or squeezed, the finishing is not worth being outsourced.*
4. *When the raw material is cut and/or chipped and squeezed, and the pressing is the last step in the order, then the steps before pressing are worth being outsourced.*
5. *If the work piece affects the working core competencies, that is, it is cut and / or pressed and after these operations the material is machine-cut, the total technology remains within the enterprise. Even if the finishing operations are not a core competency, the total machining technology is not worth being outsourced because of the pressing and independent outsourcing of the cutting operation, and the logistics costs would increase.*
6. *If there is cooperation in the technology of the product, we outsource the operations before cooperation. If after the cooperation there is machining in the plant, and it does not belong to the core competency, we can outsource this working, otherwise not.*
7. *The outsourcing of the etching is in the long-term plans, but after that the machining will belong to the core competence to stay in.*

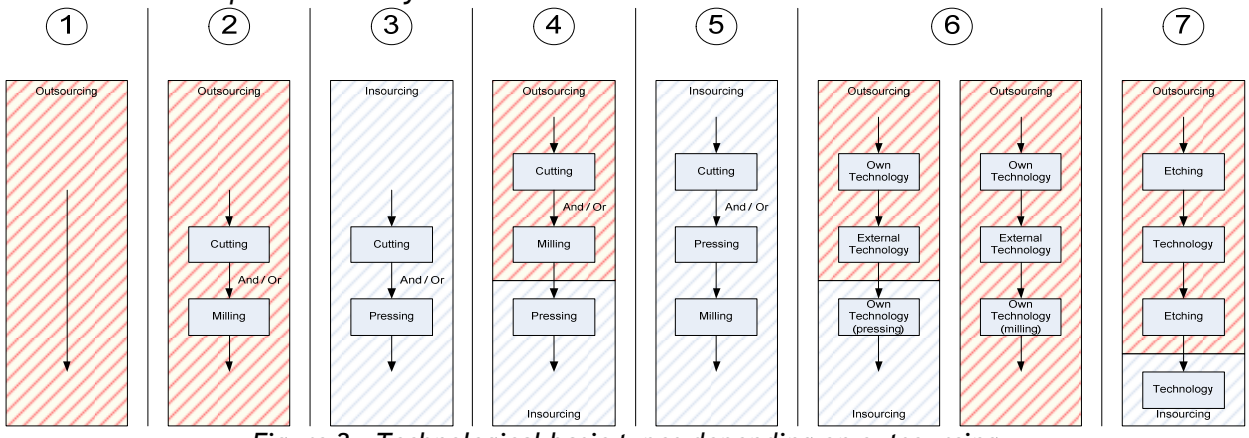

Figure 2 - Technological basic types depending on outsourcing

Outsourcing product selecting methods

The above model grouped practically is based on a MS Access database. We inserted the data from the enterprise resource planning system to this database. We sorted the data to get the model issues, as seen on Figure 3.

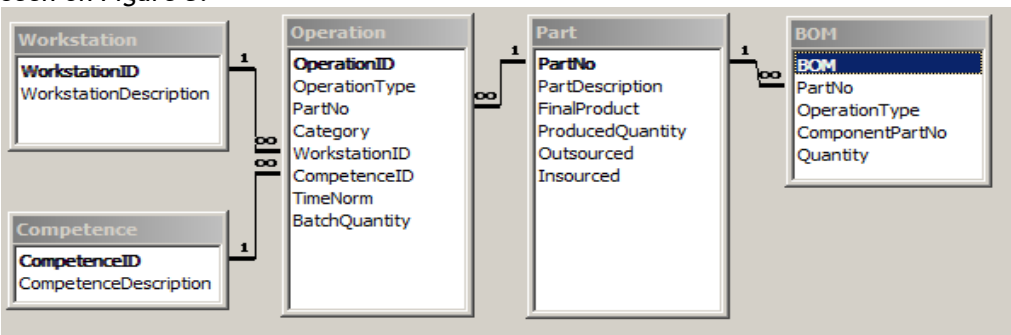

Figure 3 - Service data modeling

The multi-level product structure can be queried with a recursive algorithm of the database management.

Each level of the product structure can be connected to one or more machining records, so we can list the technological features of each machining for the given final product:

- □ *Workstation ID,*
- □ *Operation identification number,*
- □ *How much raw material must be processed on the given level,*
- □ *Calculated standard time,*
- □ *In view of the annual pieces, the annual shift load values (annual productive time in shift numbers) can be calculated.*

We imported the results obtained from the database to MS Excel because of the easy handling.

Part No.	Description	1. stage	2. stage	3. stage	6. stage	2. stage	4. stage	5. stage	6. stage	Outsourced at least in one stage	Insourced at least in one stage
1212110 878	Box 5L FT/FTA without new logo	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
1212110 897	Roof and bottom-plated box 303 MG brown	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
1212110 898	Roof and bottom-plated box, brown FT5	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
1212110 899	Roof and bottom-plated box, brown FT10	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
1231010 501	Hardening carbon 4/10/15	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
1241000 012	Water Deflector Wheel Plastic	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
1241000 013	Water Deflector (PS) FN/FN5	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
1241010 002	PRK Sleeve	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
1241016 023	Trim Wheel	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
1241016 028	Leg Lock Pivot	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE

CONCLUSIONS

The analysis presented in our article is a small organization based on logistics support strategy. It developed from the unexploited capacity of each activity, from outdated production machines to a way so that the externalities due to the extra logistics activities of outsourcing be minimized. This involved the analysis of the complete product structure, which led to the initial concept of outsourcing of some activities through investments worth keeping up, while some of the remaining categories should be outsourced. Thus, the outsourcing cost analysis of logistics costs is amended; the initial concept was made more cost-efficient.

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