

Economic assessment of the process innovation in the wood industry – a case study

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Abstract: Decision about implementation of the process innovation requiring increase in financial outlays, should be preceded by a range of diagnostics research. Analyses on the cost of investment are the basis for the economic assessment of the process innovation. The aim of the following article is to present the methodology of research and diagnostics action oriented on gaining confirmation of the economic legitimacy of the innovative purposes in the area of innovation. The following work methodology is presented as a case study.

Keywords: process innovation, economic viability,

INTRODUCTION

The period of the last 10 years of the XX century was characterized by a dynamic development of building industry, in the area of building new and renovating old houses or buildings. Then a significant increase in demand on constructional elements, such as roofings, pannelings, floor boards and scantling for production of doors and windows, may be observed. In a period of the 90's export of the wooden materials to the European countries developed. The most popular countries in this area were: Germany, Italia, Austria. Nevertheless, in the previous years, according to the EU standards, the requirements towards materials for windows and doors were restricted. Especially the standards are connected with the wood density (used in a production of doors and windows) and it should not be less than 600kg/m³. The EU standards presume that doors and windows are integral elements of the building/ construction. Wood density determines its mechanical resistance, which limits the possibility of placing heavy, thick window glasses with appropriate thermal conductivity, as well as fittings and anti- burglary window glass. Proper quality of glass and fittings is a guarantee of stability and stiffness of given element as well as better and more sure installation within the building construction/ architecture.

Starting production with the use of the new types of wood is connected with the need for buying a gluing press with greater efficiency and higher level of modernity. The requirements set by EU experts in the area of building and construction do not give us any other solution, in terms of the change of the higher constructional standards of the building. Oak scantling, which dominated production so far in most of enterprises, now do not fully meet the norms, with its density about 500kg/m³ is not a guarantee of the estimated durability presumed for building constructions. Nevertheless, before the enterprise takes decision concerning implementation of the innovative process, partially determined by the need for introducing to the production process improved technological device, a series of diagnostic consultations should be conducted.² The above mentioned research is focused on diagnosing the profitability of the investment plans, which become essential while buying new machines,

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² Janasz W., Kozioł K.: *Determinanty działalności innowacyjnej przedsiębiorstw*. Polskie Wydawnictwo Ekonomiczne. Warszawa 2007, p.68

or devices. The diagnosis is therefore the basis for the economic assessment of the process innovation.

PRESENTATION OF THE OBJECTIVE METHODOLOGY AND RESEARCH COMPANY

The aim of the research undertaken in this publication is the economic assessment of process innovation. The research method used in order to show the research process is a case study. The case study is the one of the qualitative research methods. The main purpose of this method is the best illustration of a case. It is a thorough analysis of a particular phenomenon. This study was conducted in accordance with the methodology of the research presented below:

- presentation of the subject of research, where mainly characterized by an increase in sales of the company,
- the proposal process innovation, which in this particular case requires capital expenditures for the purchase of a new machine, the characteristics of the new device,
- comparison of existing and planned (after the suggested process innovation) unit cost of production 1m³ layered laminated scantling. This comparison is ordered to show the differences and benefits of the implementation of the proposed solution,
- Calculate the payback period of the planned investment,
- Conclusions.

Subject of research. Carpentry and wood-working plant operates in the District of Częstochowa, Silesian Province. It is the region with a joinery tradition and a great number of enterprises representing wood industry. The owners of many of these enterprises, as a result of cooperation and coordination of innovative actions, are affiliated in a “Silesian Wood Cluster”.

The enterprise offers a wide range of wooden products, and is especially focused on production of solid and layered glued scantling. Between the years 1992-2009 a good situation for wood industry took place, both for sales national and international. Abrasion of the material should be at the level of 500-600m³ per month, and received wooden balls and lumber is intended to be sold, or passed to the further production of the devices. On the basis of the analysis including years 2009-2013 it may be concluded that annual sales of goods oscillated between 2550 and 2860m³. What influenced the changed in sales was crisis, mainly in building and construction industry. The subject of export, which was 30% of the whole production, became a square edged scantling, rafters and patch construction, or pallets element. The requirements of national and international clients in terms of air moisture made the owner buy a new „cell drier”. The requirement for correct functioning was met by buying a new cauldron with heat efficiency 800 kW. Increased abrasion and production caused that the amount of sawdust and wood waste was sufficient for constant production of thermal energy. The developmental strategy is directed on the improvements in the manufacturing process, in order to improve quality, reduce costs, think about determined innovative activities in terms of increasing efficiency of work by buying new machines and technologies.

CHARACTERISTICS OF THE DEVICE AND TECHNOLOGICAL- CONSTRUCTIONAL CONDITIONS OF ITS INSTALLATION

Project of a process innovation requires buying of a gluing press, type ProfiPress L2500 produced by a German distribution group “Weinig-Gruppe”. Choosing this supplier is the most profitable, as:

- They offer the lowest price for the devices,
- The company uses such devices and is sure that the quality is satisfactory; sometimes client receives a discount.

- While having the equipment, it will be easier to work on technical project for installation and its realization by service company and service (guarantee).

The gluing press ProfiPress L2500 is a device for gluing wooden tabular elements with simple operations, with optimal distribution of forces/ powers the use of pressure segments.

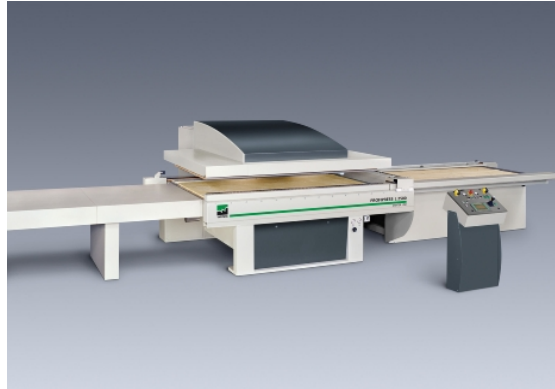


Figure 1. Gluing Press ProfiPress L2500

Source:<http://www.weinig.com/C1256F98005C541E/CurrentBaseLink/W269AHW3254ALPAEN?open&l=yes>

The device is characterized by the following technical parameters:

- voltage supply – 3x230V/400V/50Hz without breaks and decrease below 5%,
- total power of the device- 70kW
- required parameters for pneumatic installation p=8bar
- total weigh of the device is Q=5Mg (5 ton)
- gluing efficiency, which is dependent on the dimensions of the material and time of glue drying (type of glue) and type of wood – 2,5÷3m³/h.
- height 940mm
- the length of the glued elements 600-3700mm
- Warming up the elements that will be glued- with the use of a high- frequency generator. Lamella³ used in the process of gluing and pressing should be whittled paralelly⁴ and at right angles. Wood moisture has to be maintained at the level 10% ± 2%. Deviation in the thickness of the glued lamellas cannot be greater than 5mm at the length of 1 meter. Operating conditions for the device: the temperature limits within the room should be 15-30% and moisture between 40-65%. Before the process of laminating and pressing starts, on the previously prepared strips the glue is applied (Prefer 6415, class D3) with the use of a special head of the device dosing glue. Appropriately prepared lamellas with the cover of glue on them are transported to the drain table and then slided to the Press with the use of a tray slide. After filling it in, the process of pressing and laminating starts, after which the ready-made elements of the scantling are slided to the recipient table.

Integrated system of applying glue is designer and intended to apply a one-component glue. Its consumption is dependent on the type and parameters of the wood moisture, the dimensions of the glued elements and thermal- hygroscopic conditions of the room. The automatic gluing station with a head precisely doses glue in accordance with the system, , automatically calculates and places the contents within the press as well as on the table. The process of gluing takes place according to the system of precise cored application with a layer depending on the thickness and type of wood. The device is easy to be cleaned and

³ Lamella –strip with the rectangular cross- section,

⁴ Paralelly – linearly parallel

maintained in proper condition. Below there are the basic construction conditions that should be met in order to make it possible for the supplier to install the gluing press::

- Properly prepared foundations for fixing the machine with thickness 200 mm; reinforced by static load 30N/cm²,
- Supplying energy utilities: water, air and electricity with appropriate parameters
- Installation of the ventilation devices, allowing to maintain proper parameters of moisture and temperature.

ProfiPress L2500 device, in accordance with the producer's affirmation, meets the CE requirements and is constructed according to the UE requirements concerning construction of the machines. The supplier, within the contract, offers installation, starting the machine and staff training. The investor ensures meeting the construction conditions and help of 2 or 3 people during installation. Help in the order realization as well as warranty period and service time is provided by Polish representative „Weinig Gruppe” based in Gliwice.

ECONOMIC ASSUMPTIONS OF THE PROCESS INNOVATION PROJECT

Innovation process of buying a gluing press and changing the way of laminating scantling should be coordinated by a team consisting of 3 people, including 2 partners and 1 production manager. In the area of their responsibilities there should be included the development of the technological- organizational and economical- financial assumptions. The success of the project is dependent on the proper pace of its realization. The basis for the decision concerning the realization of the project is conducting the economic analysis in the area of lowering the costs, energy and materials (especially glue) used for work. Comparing their present value with the parameters expected after installation of the new device, it will be possible to evaluate the project, taking into account that it is quite capital- consuming.

Table 1. Statement of the previous and estimated unit costs of producing 1m³ layered laminated scantling.

Type of device	Energy consumption		Glue consumption		Unit time of work		Total
	kWh/m ³	Cost(euro)	kg/m ³	Cost(euro)	h	Cost(euro)	Cost(euro)
Gluing press used so far	50,0	10,76	4,5	8,61	1,00	5,98	25,35
Gluing press ProfiPress L2500 being the subject of analysis	24,0	5,02	2,5	5,98	0,40	2,39	13,63
Subtraction	26,0	5,74	2,0	2,63	0,60	3,59	11,72

Source: Own elaboration based on the available materials and technical documentation of the gluing press prepared by „Weinig Group”.

Annual production of the laminated scantling in 2012 reached 1100m³. Maintaining production at this level, the savings because of the project implementation were equal:

$$\Delta K = 1100\text{m}^3 \times 11,72,00\text{euro}/\text{m}^3 = 12892,00 \text{ euro}$$

Estimated cost of the whole project is : Ki=53827,75 euro. Hypothetical time of the return in investment is therefore:

$$t = \frac{K_i}{\Delta K} = \frac{53827,75}{12892,00} = 4,17[\text{years}]$$

The time will be reduced, when the enterprises increase the production. Changing work organization and focusing on the production schema with the use of the new gluing press may be presumed that the target annual production level will be 1800 to 2000m³. This direction of changes is a capital- consuming technological progress, because the increasing level of mechanical labor decreases unit time of human labor. The positive influence on the profit

earned by the owners will have the great amount of depreciations calculated together with the monthly costs of the profit gained by the enterprise. It will be equal 1,17% of the investment value. The suggested project of technological innovation, thanks to automation and modernization of the gluing process, will allow to eliminate the product defects in the area of oversized surface roughness and discoloration caused by inappropriate amount of glue in a given layer. It also allows to improve the standards of human work, lowering its nuisance and increasing safety.

CONCLUSIONS

The technological- organizational structure presented above allows to lower the costs of montage of the new device for joining wooden elements. The economic analysis of this project allows to think positively about the effects of its implementation. New gluing press will allow to eliminate the revealed defects of the products, which would not undermine the clients' trust. It was very useful while formulating the objectives of the innovation process to analyze the profitability of the projected innovation being the basis for the economic assessment.

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Streszczenie: *Ocena ekonomiczna innowacji procesowej w przemyśle drzewnym - studium przypadku.* Decyzja o wdrożeniu innowacji procesowej, która wymaga poniesienia nakładów finansowych powinna być poprzedzona szeregiem badań diagnostycznych. Badania opłacalności inwestycyjnej stanowią podstawę oceny ekonomicznej innowacji procesowej. Celem niniejszego opracowania jest zaprezentowanie metodyki postępowania badawczo-diagnostycznego ukierunkowanego na uzyskanie potwierdzenia zasadności ekonomicznej zamierzeń innowacyjnych w zakresie innowacji. Niniejsza metodyka postępowania ukazana jest w ramach studium przypadku.

Słowa kluczowe: innowacja procesowa, opłacalność ekonomiczna,