Computer-aided Resource Consumption Costing for a Fiberboard Producer – an Implementation Report

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Abstract *The article presents a costing system for a fiberboard producer. Resource consumption costing was chosen as the underlying cost accounting methodology. Technological links between the consumption of resources and final cost objects have been reflected in designing the costing system. Allocation bases derived from the features of the production flow for allocating resources costs to cost objects have been proposed. Dedicated tools for collecting and processing cost and quantity data have been invented. Integration of non-integrated functional modules and spreadsheet computations for the purpose of the costing model was the IT challenge in the researched company. Attention was given to the cost flow of multi-phase production and the complexity of finished products.*

Keywords: Resource costing, resource consumption, phase production

1 Introduction

Cost analysis and cost management are key functions for the majority of producers that seek excellence, or at least improvements, in their information-based management practices. Proper, unbiased and true information on costs of products (and other cost objects) plays an important role in both strategic and operational management. Reliable, analytical information in both ex ante and ex post modes helps in sound planning and running of the business.

Costing systems of nowadays are subject to constant changes due to a rapid development of computerized tools for accounting, budgeting, performance management and other management functions. Traditional full costing methods, which are required for valuation and disclosure purposes imposed either by national accounting laws or international standards, are not a satisfying solution for many companies operating in volatile reality. Thus, modern, tailor-made, computer-aided and integrated costing and performance management systems are highly valued by practitioners.

The rise of the activity-based costing [6], developed next into activity-based budgeting/management (ABB/ABM), and recently transformed into Time-driven ABC [7], has been fertilizing the imagination of cost accountants, cost managers and costing systems designers worldwide. Moreover, even non-financial managers have become aware of new perspectives emerging from recent developments in the domain that was perceived as stagnated.

The development of costing methods has been very rapid for the last 20-25 years. Nowadays there is a wide choice of costing procedures including:

- traditional full costing, simple volume-driven or with complex multi drivers, with variations between industries and branches,
- traditional variable costing, for various purposes,
- contribution accounting based on marginal costing with multi-level contribution margins,
- combined contribution accounting with activity-based costing,
- modern activity-based costing of different genres at different stages of development, from single-step ex post systems, through the classic resources-activities-objects solutions, enriched with the ex ante perspective,
- time-driven ABC systems, where the consumption of activities of human and material resources are measured with standard time.

Recently the idea of resources consumption accounting (RCA) for production has been emphasized [1], [2]. Some authors consider RCA the first step in the process of ABC systems implementation [9]. Generally, the underlying assumption of RCA is first to identify the company's resources and assign costs to them, and second to allocate costs of resources either to activities (when ABC is applied) or directly to cost objects (if traditional costing is concerned). For example, with reference to production if "machine X" is considered an element of resources, then the "work of machine X" is an activity. This straightforward logic results in the allocation of machine costs directly to final cost object, i.e. the final product, manufactured thanks to the activity of the resource element.

All the above-mentioned solutions require computer aid. On one hand there are sophisticated costing solutions performed by means of advanced integrated software, but on the other hand, stand-alone, tailor-made, spreadsheet-

based, unique applications are used in many companies [3].

The aim of the paper is to present the practical implementation of the idea of a tailor-made stand-alone resource costing (accounting) system based upon production resources of a manufacturing company in the fiberboard industry.

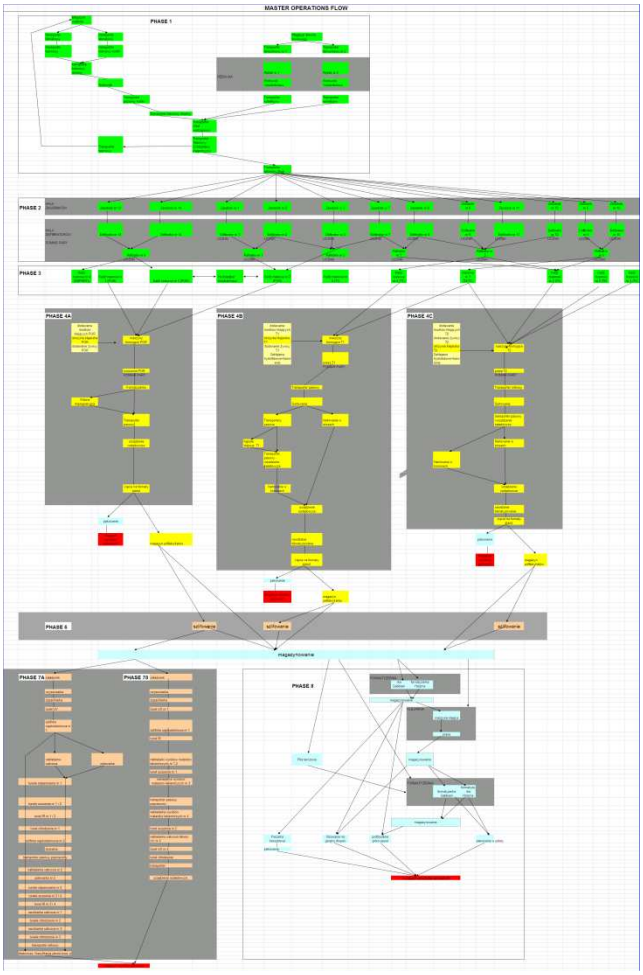
2 Characteristics of the Company

The company is a medium-sized player on the market of wet-processed fiberboard. During the implementation period the company total sales revenue reached an average of PLN 50 m a year, one fourth being an export stake. The efficiency of the wet-processed hardboard business in Poland, that has usually been oscillating around 2%, is not a promising incentive for heavy capital investments. Hence the search for better profitability and performance management.

Wet processing requires rigorous standards for the protection of the environment. A large amount of poisonous pollution has to be biologically neutralized and recycled in the course of environment-sheltering actions. The company operates facilities of biological and natural sedimentation. Moreover, specialized service units have been organized, i.e. sewerage, waste and dust departments.

Production technology of the company is a typical example of multi-phase processing along with final customization with the use of machine work centers (MWC). The variety of finished products is derived from the same basic raw material input which are pre-processed wood scraps and, to some extent, stack wood (phases 1 and 2). Enriched with chemical direct materials (adhesives, glues, hardeners, catalysts, inhibitors, aggregators) and technological water (phase 3), it is further developed into standard pulp lace cast upon lines of dedicated outcome. At the end of each of three casting lines standard or non-standard products come out (phase 4A, 4B and 4C). The standard ones are then subject to grinding and cutting and are moved to inventories in the final commercial sizes. However, the non-standard ones are subject to various technological operations that give final customized features to them (phases 6, 7 and 8). Hence, the abundance of potential end products of the company is huge due to possible different settings of the CNC machines. Thus, the well established wood processing technology itself, accompanied by the choice of customizing machines allows the producer to compete in the demanding market conditions. A general view of the processes is depicted on Figure 1.

Figure 1. General Flow of Technological Processes



From the commercial point of view, the final products of the company range from regular dimension and thickness/density plain hardboard, lacquered wood-based decor hardboard, regular size oil-hardened boards and extra-hard bituminous-based boards, as well as roof, floor and wall insulating boards (so called porous or low-density fibreboards), and insulation boards for sound absorbing chambers. The company's products are in high demand from the furniture, construction, automotive, railway, tramway and shipbuilding industries. The company is a supplier for European as well as some African clients.

The final cost object unit embraces all sorts of end products which are the commercial offer of the company. They have been first split into the following master groups:

1) Strategic products (STR),

2) Special products (SPE),

3) Regular products (REG),

4) Other products (OTH).

Then each product group has been explored in detail as far as types of final products from the commercial viewpoint are concerned. As a result, the full

commercial offer of the company has been itemized into the total of 109 final following cost object:

1) STR – 21 types,

2) SPE – 27 types,

3) REG – 32 types,

4) OTH – 29 types.

Every final product received a cost object account in General Ledger.

3 Application of Resource Consumption Costing to Production Processes

Every model of a costing system built upon the activity-based costing notion should consist of three modules:

- resources unit,
- activities unit,
- cost objects unit.

ABC maintains that cost objects consume activities and activities consume resources. Hence, resources costs are assigned to activities based on their use of those resources and then activity costs are reassigned to cost objects (outputs) based on the cost objects' proportional use of those activities.

Allocating costs to final cost objects in a two-step procedure necessitates defining relationships between both resources and activities, and activities and cost objects. In consequence, clearly measured allocation drivers should be identified, i.e. the resources drivers and activities drivers.

The structure of the resource consumption costing model consists of two modules:

- resources unit,
- cost objects unit.

The underlying idea of resource-based single-step allocation procedure explores direct connections between a single resource engaged with a cost object charged with a share of cost of the resource. There is no intermediate level of double-step allocation: firstly: costs of resources to activities performed by those resources and secondly: cost of activities to cost objects which consumed those activities.

The solution presented in this paper belongs to the family of full costing methods. The conviction of usability of resource consumption costing system stems from the authors' practical and theoretical experience gained in the course of implementing different models of performance control applications into the operations of Polish manufacturing companies. The full costing procedure presented in the paper belongs to dedicated solutions with necessary modifications with reference to:

- detailed identification of production resources in line with the "resources usage – cost drivers – cost object" logic,
- differentiation of end-products from both the technical and commercial viewpoints,
- development of newly-designed costing paths in accordance with the resources consumption by final products,
- full awareness of the functional capabilities of existing computer-aided modules of management information system operated by the company,
- capital restraints concerning the acquisition and implementation of expensive and extensive IT packages.

As can be expected from a full costing system, the company can easily identify raw materials and direct material costs. Raw materials are wood extracted from forests managed by The National Forest Holding in Poland. Direct chemical materials can be directly traced to production lots and result from chemical prescription. In addition, a vast amount of technical water from the neighbouring river is used for preparing the production input.

As far as indirect costs are concerned, prior to the implementation the described company had identified only four main production departments:

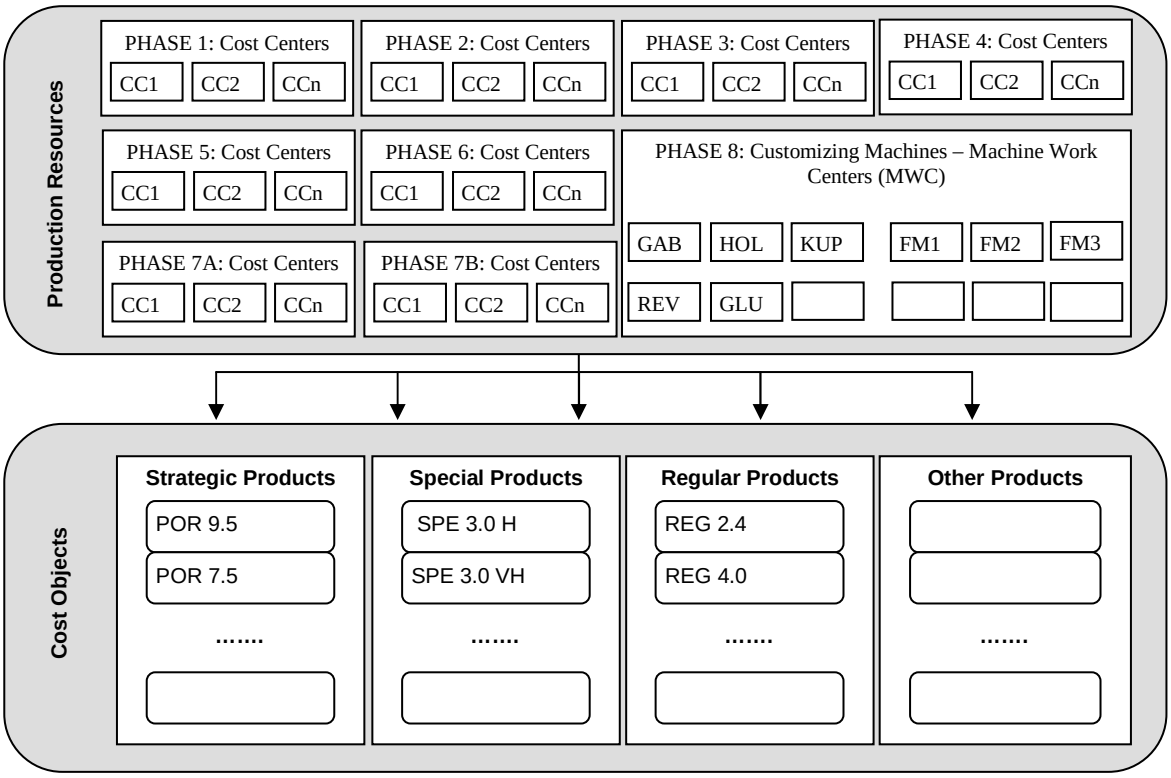
- raw wood store and pulp pre-processing,
- pulp casting lines,
- board veneer lines,
- customising machines.

The issue is that the company operates various production resources that are technologically organised into clearly distinguished production phases. To make it more transparent, there are technologically justified inter-operational warehouses located between the phase of pulp casting lines and the veneering, lacquering, cutting, formatting and customising lines and machine work centers. Moreover, in the early phase of wood pulp casting the consecutive processes are normally set on obtaining half-products in the form of fibreboards of required thickness, density and hardness. Thus, not only very soft and soft boards can be obtained, but also hard, very hard and toughened ones. And this definitely brings about significant alterations in the manufacturing cost of

the half products and final products. Hard and very hard boards are obviously more cost-consuming than the soft and porous ones and hence the differentiation of costing procedures between them is necessary.

Bearing in mind the abundance of possible finished products from the commercial perspective and their diversity according to customers' needs, the costing procedure in such conditions should reflect the complexity of technological processes of each phase as well as regular and customization processes in the final steps of production. The general idea of resource consumption costing is depicted on Figure 2.

Figure 2: General model of single-step allocation in resource consumption costing



From the purely technological point of view the production processes in the company have been structured into the following production phases:

1) Raw wood scraps and wood logs chopping,
2) Pulp pre-processing,
3) Chemicals pre-processing,
4) Pulp casting (three separate production lines),
5) Kindling (by-products line),
6) Grinding,
7) Painting and lacquering (two product-oriented dedicated production lines),
8) Customizing.

The operations in the phase of customizing are performed by specialized machines that are located in a separate production department. They are nested into machine work centers (MWC) and are CNC lathes, millings, moulders, drillings, panel saws, revolving millings, and others.

4 Reasons for Resource Costing

The idea of and necessity for resource costing system arose from the need of the company to amend costing procedures for the reason of a fast changing variety of products. In the early 2000s the company experienced a rising demand for non-standard products which would be specially processed to meet the clients' needs. Hence, it turned out to be necessary to equip the production plan with special purpose customizing machines. At that time the final phases of the technological processes were terminated by final cutting to standard dimensions and stacking the hardboard in the finished goods warehouse. However, with the increasing demand for fine finishing, pattern painting, lacquering, and non-standard cutting, the management has decided to invest in special equipment. Since then additional phases of the technological processes have been added to the production flows. Other problems emerged with the

shortness of the special order production lots. The newly-bought equipment has never been engaged to its full capacity thus creating problems with productivity and performance.

The implementation works were perceived as an introductory step towards an activity-based costing system to be applied in the future. At that time the role of consultants was to identify the production resources engaged in all of the production stages of the company. Thus, the aim of the project was not to develop an elaborate and expensive costing system but rather to prepare grounds for further developments.

Designing the above described system necessitated the reorientation of the approach towards cost recording and accounting. In order to achieve the aims, it was necessary to:

- establish 214 GL accounts for costs by nature (instead of previous 66),
- define phase-oriented cost centers (in place of 4 production departments),
- differentiate between cost sub-centers accordingly to production phases (previously non-existent and not reflected in the GL recording system),
- introduce 109 final cost objects (replacing previous 9 groups of products),
- elaborate a spreadsheet costing module,
- define the rules for data transfers form stand-alone modules and GL to the spreadsheet module,
- define the rules of recording the results of the costing procedure back to GL accounts.

However, many existing solutions and information flow channels have been adapted to the new concept, the main being:

- description of the technology and all chemical formulas,
- mass allocation bases for production phases 1-3 and dimension allocation bases for production phase 4,
- tools available for collecting detailed data, for example: timesheets for labor hours, sheets for recording the mass of production, machine registers, goods flows registers,
- entire existing software for production planning, general ledger and subledgers, payroll, staff management, sales and invoicing, material handling, asset management and CRS.

The following key expectations with respect to the new costing system were formulated by the client:

- use of existing accounting software,
- use of existing material handling and dispatching software,
- integrating all computations into a spreadsheet,
- itemized identification of expenses with connection to personal cost control and cost responsibility,
- detailed analysis of profitability of final products based upon selected criteria,
- relative simplicity of operating and understanding the new system for non-economists,
- low cost of the system application.

5 Costing Procedure

The adopted costing procedure has been built upon the following general assumptions.

Natural costs are traced to particular cost objects and cost centers. Cost centers are the prime resources to which natural costs are originally recorded, whereas natural cost themselves are treated as simple costs of running and maintaining those resources.

Costs of maintenance departments (mechanical, electrical, transportation, environment and others) are allocated to cost centers for different production phases upon a cost base that is proper for each maintenance department. Next, costs of the so-called supporting departments, i.e. technical steam department and technical water department, are allocated to cost centers of production phases. The allocation bases are: GJ for heat and tonnes of overheated steam for the first, and tonnes of technologically enriched water for the latter. Further, costs of Phase 1 (Wood Processing) and Phase 2 (Pulp Pre-processing) are allocated to the output. Here allocation bases are the mass of ready-to-process wood and the mass of ready-to-cast pulp in tonnes of respective substances. Costs of the supporting phase of chemicals pre-processing (phase 3) are allocated on the base of the mass of the substance.

Then the costing procedures move to pulp casting lines where predefined technical parameters are to be obtained in order to ensure the desired quality of final products. From the technological perspective each of three casting lines serves to manufacture a specific range of products. For example, the porous output can only be obtained from the Phase 4A. Phases 4A, 4B, and 4C have thus their own allocation bases which are the cubic meters of the products (end or half) obtained from those phases.

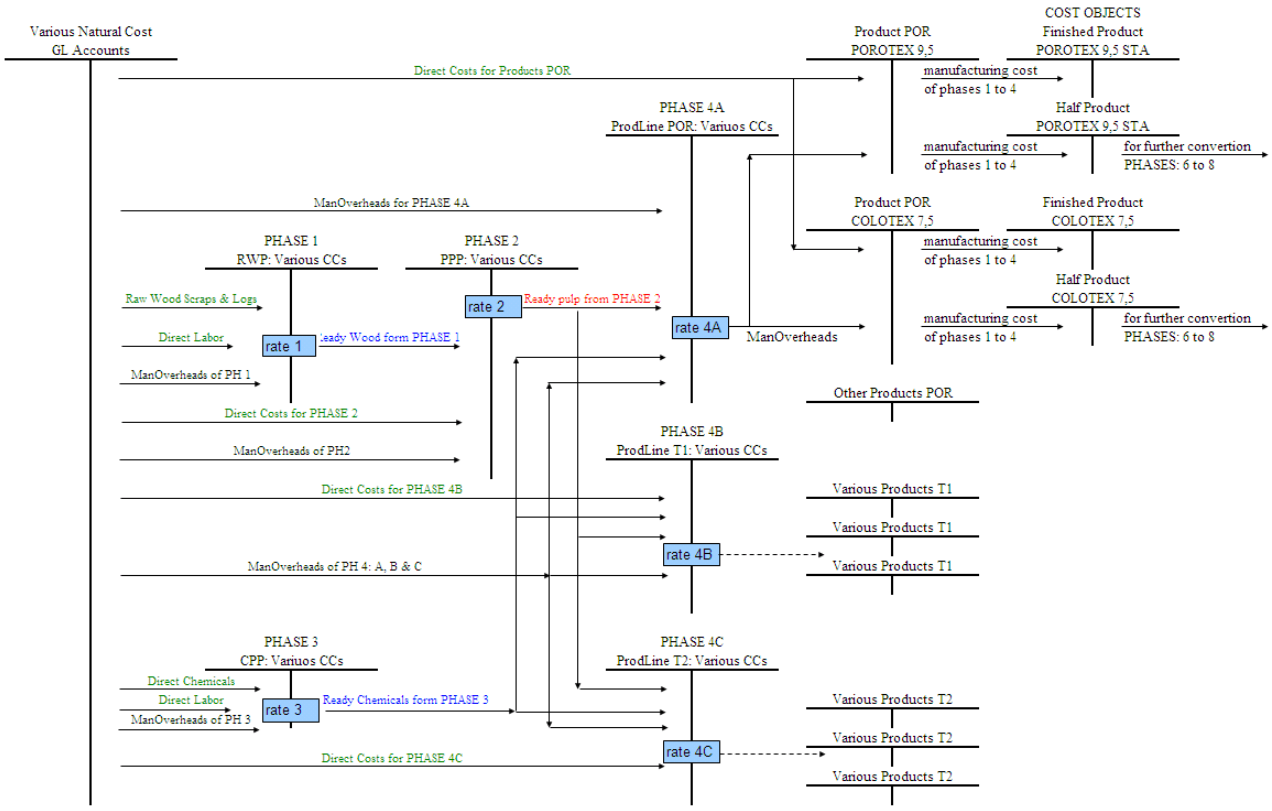
For the non-lacquered regular finished products the procedure stops here. But in the case of the lacquered regular ones costs of phase 6, 7A or 7B should next be taken into account. Different costs of which the painting

operations are composed are allocated upon different bases. For example, direct materials used in these phases are primarily recorded to each batch separately, whereas direct labor is allocated based on labor hours, and indirect manufacturing costs are allocated upon the number of machine hours spent on each batch.

Finally comes phase 8 which is made up of customizing operations. Each of 12 specialized machine work centers (MWC) is treated here as a separate resource with dedicated allocation bases. Labor hours is the allocation base for direct labor costs of workers who process batches of products. The total costs of running and maintaining the machines divided by the number of machine hours gives the cost rate per machine hour. Any costs of direct materials necessary for customized production are registered to respective batches. Setup costs are included in the rate per labor hours.

Figure 3 depicts a section from the description charts of the cost flow in the company.

Figure 3: Section of General Ledger Scheme of Cost Flow



6 Further Developments

From the user's viewpoint, development of the described resource consumption costing system should aim at achieving several future goals:

- amending the process of recording source documents to GL resource accounts,
- strengthening the role of the responsible engineer in the process of classifying natural costs to proper resources,
- speeding up the process of collecting and inputting necessary information for the purposes of the costing procedures,
- abandoning pendrive-based data transfer in favor of an intranet data input and transfer,
- costing intra-operation warehousing of half-products; currently the cost of this activity is a part of the cost of general inventory stocking and is charged to warehousing expenses,
- reorganizing the data transfers form stand-alone dedicated modules (payroll, materials handling, asset management, maintenance management, general ledger natural cost accounts) to the spreadsheet-based costing procedures, which are now the main IT tool for the entire concept,
- integrating budgeted vs. actual data variance analysis into the spreadsheet costing procedure,
- introducing the concept of activity-based costing to customizing, packaging, warehouse logistic and dispatching operations.

Identification of resources, along with analysis of activities and differentiation of cost objects, are usually the main step towards an implementation of activity-based costing. Hence, elaboration of business concept of the entity for the purposes of an integrated MRP or ERP system application can be a further perspective for the analyzed company.

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