

## **MANUFACTURING COST POLICY DEPLOYMENT (MCPD): ALIGNMENT OF IMPROVEMENT OPPORTUNITIES**

**Alin Posteuca**

*Exegens Management Consultants, Bucharest, Romania; [alin.posteuca@exegens.com](mailto:alin.posteuca@exegens.com)*

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**Abstract:** *Providing a reasonable level of profitability through productivity and thus by continuously reducing costs is a perennial concern of the management teams of any manufacturing company. The MCPD system is a manufacturing cost policy aimed at continuous cost improvement through a systemic and systematic approach. The MCPD is a methodology that improves the production flow driven by the need for manufacturing cost improvement for both existing and future products through setting targets and means to continuously improve production process productivity for each product family cost. Using the MCPD system ensures a clear view of the current stage of manufacturing cost improvement targets towards planned stage of objectives and the continuous targeting of all systematic and/ or systemic improvement opportunities to achieve internal profitability directly from processes related to manufacturing flow. Every employee fully understands this way its role within the company from the perspective of fulfilling the company's manufacturing cost targets. The MCPD system was initially developed using action research method.*

**Key Words:** *manufacturing cost improvement (MCI), productivity business model (PBM), annual manufacturing improvement budgets (AMIB), waste elasticity of losses (WEL), and management branding (MB)*

### **1. CHALLENGES FOR CONTINUOUS MANUFACTURING COST IMPROVEMENT**

Planning and monitoring the continuous reduction of unit costs is still an ongoing challenge for manufacturing companies [1] [2] [3] [4]. However, the systemic and systematic approach to cost reductions for each product family cost and the creation of the prerequisites for a real and consistent competitiveness through price and operating profit level generate a lot of challenges for production companies. These challenges include: (1) design and continuous redesign of a system of targets for productivity and for manufacturing cost improvement continuously aligned to the vision, mission and strategies of the production company; (2) implementation of the strategic objectives of continuous reduction of unit cost and every cost structure, both for existing and future products [5], within each product family cost, at the level of processes and activities, totally involving all employees at all levels of the company; (3) the need to have an annual improvement budget for both existing and new products by continuously investigating the relationships between the process costs and losses and the process waste, (4) planning and continuous monitoring of the performances of systematic and systemic improvements in order to meet manufacturing cost improvement targets and increase skills to meet the productivity objectives on medium and long term [6], [7].

In this context, the continuous exploration of the internal profit reserve obtained directly from the continuous improvement of costs related to losses and waste within the processes of each product family cost is a way to ensure long-term competitiveness of manufacturing companies [8].

### **2. THE CONCEPT OF MCPD: DEFINITION, STRUCTURE AND PRINCIPLES**

MCPD is the methodology that improves the entire production flow starting from the need for continuous reduction of unit costs both for existing and future products, by converting the cost strategies in systemic and systematic improvements through a top down and bottom up approach. The definition of MCPD is: "MCPD is the process of translating the strategic objective of reducing production costs in the long run toward the improvement of annual systematic activities and toward annual systemic improvement actions by setting targets and means to improve process costs of families of products (...)" [9, p. 81].

From the perspective of MCPD system, establishing and fulfilling the manufacturing cost improvement targets (MCI) for each product family are structured in three phases and seven main steps (see Table 1) [9, p. 86-88].

*Manufacturing cost policy analysis* is the first phase of the MCPD system. The main goal of this first phase is to understand the current state of manufacturing cost improvement and the connections between costs, losses and waste, and the cost reduction strategy to set annual targets for costs behind losses and waste for each product family cost. Setting these cost targets is based on defining the current and future state of productivity using the *productivity business model* (PBM) [9, p. 9-66]. As an integral part of the MCPD system, PBM determines: (1) the productivity vision, (2) the productivity mission, (3) the productivity core business goals, (4) the productivity strategies, (5) the productivity policy deployment (with: (a) overall management indicators - OMI; (b) key performance indicators - KPI; (c)

kaizen and kaikaku indicators - KKIs; (d) daily management indicators - DMIs), (6) the productivity master plan for 5, 3 and 1 year; (7) the feedback (continuous monitoring of fulfilling the productivity vision by designing and continuously implementing of improvement activities and actions at productivity master plan level continuously involving all employees at every product family cost level, having the same goals and targets for manufacturing cost improvement and benefitting from a desirable contextual managerial behaviour to favour the pro productivity spirit state – *Management Branding* [10]).

*Manufacturing cost policy development* is the second phase of the MCPD system. The basic purpose is to develop the mechanism for establishing means to fulfil MCI targets through the development of annual manufacturing improvement budgets (annual manufacturing improvement budget for existing products, multiannual manufacturing improvement budget for new products, and annual manufacturing cash improvement budget for each product family cost), by converting the cost reduction strategy in real actions and activities by developing the annual action plan for MCI for each product family cost.

*Manufacturing cost policy management* is the third phase of the MCPD system. The basic purpose is to engage the workforce to achieve the MCI targets and means and thus the cost reduction strategy, cost improvement performance management, and daily MCI management to monitor the successful fulfilment of MCI strategy implementation at shop floor level by organising structured meetings to meet MCI targets.

**Table 1. Manufacturing cost policy deployment (MCPD) system (in brief) [11]**

	Phases	Steps
<b>Plan</b>	<b>Phase 1: Manufacturing cost policy analysis</b> (setting annual targets; including MCI targets)	<b>Step 1:</b> Context and purpose
		<b>Step 2:</b> Targets for MCI
	<b>Phase 2: Manufacturing cost policy development</b> (establishing the annual action plan/means for MCI targets)	<b>Step 3:</b> Annual budgets and means
		<b>Step 4:</b> Action plan
<b>Do</b>	<b>Phase 3: Manufacturing cost policy management</b> (improvements management, MCI performance, and daily cost management)	<b>Step 5:</b> Engage the workforce
<b>Check</b>		<b>Step 6:</b> MCI performance
<b>Act</b>		<b>Step 7:</b> Daily management

To ensure the full involvement of all parties, both foreign, especially suppliers, but mostly internal, especially top management team in continuously supporting the MCPD system, seven basic principles of MCPD were developed. These are: (1) *the target profit from manufacturing cost improvement does not change*; (2) *the manufacturing cost improvement targets for each product family cost*; (3) *the continuous quantifying of losses and waste in costs for*

*each product family cost*; (4) *the continuous reconciliation of annual manufacturing cost improvement targets for each product family cost*; (5) *the improvement budgets for each product family cost*; (6) *the coordination of improvements through manufacturing cost improvement targets for each product family cost*, and (7) *the waste (stocks) elasticity on losses*. [9, p. 82-85].

### 3. THE SYSTEM OF MCPD

So, the MCPD system aims at setting and meeting the MCI targets for each product family.

#### 3.1 Manufacturing cost policy analysis

The first phase of MCPD refers to understanding the context and purpose of MCI, as well as establishing targets and means for cost improvement.

In this phase, the goal is to understand exactly the current state of the production company from the perspective of the need for reducing unit costs on long term, both for existing and future products and translating those needs in processes related to manufacturing flow.

Thus, in this first phase, the key data and information on the company's production processes and the costs related to these processes are identified to establish links between costs, losses and waste in processes and means of achieving systemic and systematic improvements. The objective of continuous reducing unit costs relies on the need for continuous improvement of productivity and quality, so these two together lead to satisfy main customer needs (better, faster and cheaper).

Approaching this first phase is made by the first 2 steps of the MCPD system: (*Step 1*) *Context and purpose of MCI* and (*Step 2*) *Annual targets for MCI: cost strategy into action* [9, p. 89-156].

The first step, *context and purpose of MCI*, is considering addressing the following elements: (a) factory vision and mission, (b) core business goals, (c) long-term business, productivity, and cost strategy, (d) market context, (e) internal context, (f) basic policy, (g) mid-term business, productivity, and cost strategy, (h) actual manufacturing records, (i) actual manufacturing cost records, (j) manufacturing key points, and (k) manufacturing cost key points. The aim of this first step of the MCPD system is to analyse and understand the strategic key points of production processes, strategic key points of cost management and costs structure and relations between the MCPD system and the current production system to achieve the setting of manufacturing improvement targets in a pertinent and acceptable way, both through a top-down approach imposed by the current level of product prices for each family product cost and the acceptable profit level from the perspective of shareholders, as well as through a bottom up approach based on predetermination of the impact of the

approach to systematic and systemic improvement opportunities of losses and waste on MCI.

The second step, *annual targets for MCI: cost strategy into action*, is developing the following key elements: (a) top-down approach: annual MCI targets, (b) bottom-up approach: actual losses and waste, (c) actual costs of losses and waste for each product family, (d) manufacturing cost improvement reconciliation and setting targets, (e) annual targets for MCI, losses, and waste for each product family, and (f) aligning the organization through catchball: new prices for sale and product profitability.

Addressing the annual top-down targets for MCI, based on mid-term business, productivity, and cost strategy and manufacturing and cost key points is made to first establish the annual percent required to MCI for each product, then at product family cost level and then on the entire company level through:

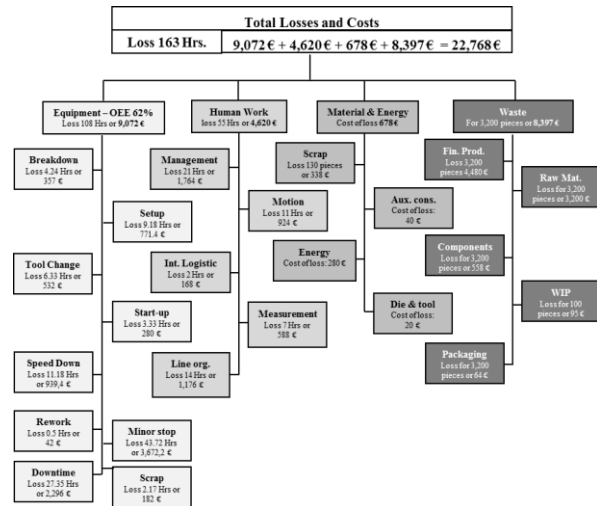
- ✓ *product-past targets analysis*: identification and analysis of the trend for the targets achieved during the period previous to MCI for each product in each product family cost and for the entire company;
- ✓ *product-market analysis*: determining the evolution of volumes sold, current unit price, target unit price, MCI targets, profit from MCI, product life cycle stage and forecast of life cycle product for next years;
- ✓ *product-process analysis*: analysis of contribution opportunities of each product to achieve the annual target profit directly from the internal production processes.

The bottom-up approach is made by identifying losses and waste for each product family cost by continuously measuring losses and waste for each process to substantiate the potential means of MCI. For this are continuously collected data and information related to *time-related losses (TRL)* (the impact on the production system outputs) and to *physical losses (PL) and waste* (the impact on the production system input sites - 4Ms: man, machine, material, and method).

The connection in the dynamic of losses and waste can be described as follows: "the emergence of equipment (1), human work (2), and materials and energy (3) losses may cause non-synchronizations along the production flow (including between processes and within processes) and non-synchronizations that are found at the level of waste (4) in flow stocks (WIP stocks and packaging stocks); these non-synchronizations create warehouses stocks (stock finished products, raw material stock, and components stock)" [9, p. 118].

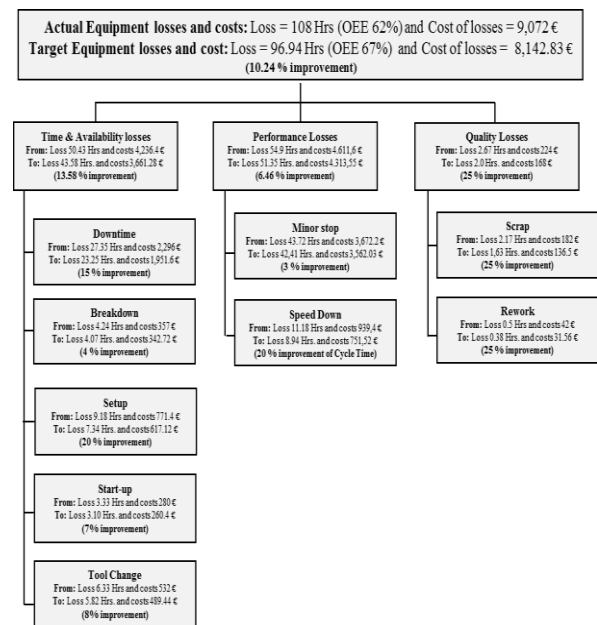
Further on, the actual costs of losses and waste for each product family is determined by converting time-related losses (TRL) and physical losses (PL) and waste in costs for each process related to each product family cost. **Figure 1** shows an example of actual costs of losses and waste for a process (a plastic

injection equipment in a company from manufacturing and assembly industry) [9, p. 133].



**Figure 1. Background on manufacturing cost policy analysis for the manufacturing process**

The annual MCI targets reconciliation and setting targets for each process refer to meeting the annual targets for MCI for each product family cost and to continuously reconciling the need for annual internal profit obtained through MCI and the real possibilities to meet this internal profit (opportunities and means for systematic and systemic improvement of costs related to losses and waste). **Figure 2** shows an example of setting potential targets for MCI and thus for losses and waste for an equipment. It is the current total offer for meeting MCI targets through systematic (kaizen) and systemic (kaikaku) improvements.



**Figure 2. Set equipment improvement targets coordinated by the need for MCI**

In general, if the annual *target profit for manufacturing cost improvement* (ATPmci) (top-down approach) is smaller than the MCI opportunities (MCIO), which relies on losses and waste improvement, then the annual improvement plan is a plan that contains only *systematic improvement activities* (SIA).

$$\text{ATPmci} \leq \text{MCIO} \Rightarrow \text{SIA} \quad (1)$$

In general, if the *annual target profit for manufacturing cost improvement - (ATPmci)* (top-down approach) is higher than the *manufacturing cost improvement opportunities* (MCIO), which relies on losses and waste improvement, then the annual improvement plan is a plan which contains both *systematic improvement activities* (SIA) and *systemic improvement actions* (sIA). [9, p. 153].

$$\text{ATPmci} \leq \text{MCIO} \Rightarrow \text{SIA} + \text{sIA} \quad (2)$$

Therefore, it requires a holistic approach at the level of each product cost family and of losses and waste costs throughout the entire production flow to direct continuously the systematic and systemic improvements in order to fulfil the MCI targets along the production flow (downstream and upstream) by aligning the entire organization through the catchball process to determine the new selling prices and the new level of profitability of products [12].

### 3.2 Manufacturing cost policy development

The second phase of MCPD refers to evaluating and planning the potential money winnings from the potential improvement projects, because unlocking resources for improvements would be easier to ensure if managers knew before the potential gains in money and not only the benefits from the time saved or avoided and the acceptable quality level.

Often from the perspective of customers, companies can have acceptable delivery times and quality level, but profitability and level of unit costs may suffer.

This phase aims at setting the annual budget goals related to MCI, at building improvement budgets for both existing and new products, determining the impact of systematic and systemic improvements on cash improvement budget, and setting the means to fulfil the MCI targets for each product family cost.

This budgetary approach of MCI is an addition to the traditional budget of manufacturing companies, specifically it refers to ensuring the fulfilment of multiannual and annual target profit, both by the contribution of the classic profit realized from sales and especially by using MCPD to save and/ or avoid costs related to losses and waste and thus to ensure the percentage of direct internal profit from the production flow processes for each product family cost.

Approaching the second phase of MCPD system is made through the following 2 steps: (*Step 3*) *annual*

*improvement and cash budgets for existing and new products*, and (*Step 4*) *action plan for MCI for each cost product family* [9, p. 157-221].

The third step, *annual improvement and cash budgets for existing and new products*, aims to address the following elements: (a) the annual target profit: target profit from MCI and sales target profit, (b) the improvement budgets for each product family cost, and (c) setting of means for MCI targets for each product family cost.

To determine the annual profit target the share of profit contribution made from MCI and profit from sale is determined. For example, it can be established that the annual target profit is 10% of turnover, the contribution of profit from MCI to be 5% and the profit from sales growth to be 5%. The share of the profits obtained from MCI can grow, for example to 6%, if sales volumes have a general downward trend in recent years.

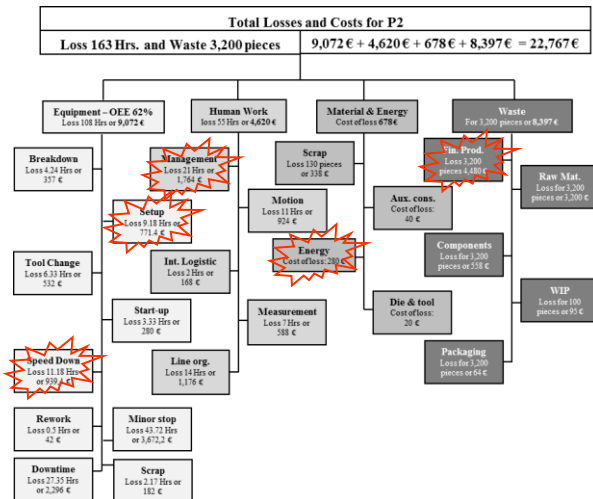
Improvement budgets for each product family cost (or annual manufacturing improvement budgets - AMIB) refers to:

- ✓ *Annual manufacturing improvement budget for existing products* (setting targets to improve MCI at the level of each cost structure in each process);
- ✓ *Multiannual manufacturing improvement budget for new products* (identifying future opportunities to improve costs throughout the life cycle of new products);
- ✓ *Annual manufacturing cash improvement budget* (monitoring the performances of improvement projects of manufacturing costs in terms of generated cash flows over time).

Setting of means for MCI targets for each product family cost requires the choice of the most effective and efficient means to meet MCI targets. **Figure 3** shows manufacturing cost policy development for setting MCI means for each losses and waste from one process (for example process P2 - thermoforming equipment) for continuous fulfilment of MCI targets. Based on the catchball process, the acceptance by all employees of means for MCI targets will be reached.

For each identified means are used methods, techniques and tools for the systemic and especially systematic improvement to ensure the continuous and consistent growth of productivity and quality, aligned to the vision and mission of the company regarding productivity.

The fourth step, *action plan for MCI for each cost product family*, aims to develop the implementation plan of activities for systematic (kaizen) improvement and actions for systemic (kaikaku) improvement to lead to getting the results expected from means chosen in order achieve MCI. The role of the catchball process is important again because the reconciliation of means and targets at MCI level is made at all levels within the company (from top managers to operators and back).



**Figure 3. Setting MCI means for each losses and waste from each process for continuous fulfilment of MCI targets**

### 3.2 Manufacturing cost policy management

The third phase of MCPD aims at engaging the workforce to execute the cost strategy (by implementing the annual plan previously developed for meeting reconciled MCI targets with the aid of means agreed by the catchball process), cost improvement performance management, and daily MCI management. In fact, after being set targets for MCI in the first phase of MCPD system, after being set means in the second phase, now it is the time to perform daily management to achieve the tangible and intangible results set for MCI.

Approaching the third phase of MCPD system is made by the last three steps which in fact is closing the plan-do-check-act cycle (PDCA): (step 5): *engage the workforce to execute the MCI targets and means*, (Step 6): *cost improvement performance management*, and (Step 7): *daily MCI management* [9, p. 225-256].

The fifth step, *engage the workforce to execute the MCI targets and means*, considers approaching the following elements:

- ✓ *departmental organization for achieving MCI targets* to establish clear roles for each person involved in the MCPD system, especially the roles of top managers;
- ✓ *sources for determining training needs related to the fulfilment of MCI targets*;
- ✓ *initial and updated annual training plan to achieve the MCI targets*;
- ✓ *systematic and systemic projects management to achieve the MCI targets: solutions, resource, and benefits*;

So, from the perspective of MCPD system, the continuous involvement of all people responsible for achieving the MCI targets is vital to sustain a pro-productivity and pro-cost culture, by keeping the top managers interested to make continuous improvements, guided by the need for obtaining

internal profit from the improvement of losses and waste from production processes and not just from the sale of goods and services.

The sixth step, *cost improvement performance management*, is an essential step of the MCPD system because the profitability obtained for each product of each product family cost and the contribution of each department in reaching the MCI targets are checked. The basics of the sixth step are:

- ✓ *evaluation of the systematic and systemic improvement projects to achieve the MCI targets*;
- ✓ *equipment and people systematic cost improvement performance management*;
- ✓ *systemic cost improvement performance management*.

*Evaluation of the systematic and systemic improvement projects to achieve the MCI targets* addresses the periodic examination of material resources consumed compared to planning and framing within the initial planned time of improvement projects. For any exceeding of resources consumption, including the time initially allocated to each improvement project, the root causes are looked carefully and the ways to provide all necessary resources to complete the improvement projects are sought in order to fulfil the productivity strategies, vision and mission by meeting the targets for current KPIs [9, p. 9-66, 230-232].

*Equipment and people systematic cost improvement performance management* approaches the analysis of variations that can occur between the moment of calculating initial losses and the determination of associated costs and variations between the moment of setting MCI targets and the moment of analysing the performance of improvement projects related to the effectiveness and efficiency of equipment and people.

*Systemic cost improvement performance management* mainly approaches the concept of *waste elasticity of OEE*, ( $E_{woee}$ ) and *waste elasticity of losses (WEL)*. *Waste (stocks) elasticity of OEE* "expresses the modification of stocks quantities determined by the modification of the initial percentage of the OEE, for which the production level was planned, and implicitly the level of stocks of raw materials, components, and WIP. The coefficient of waste elasticity (stocks) depending on OEE is determined by comparing the percentage modification of waste (stocks), to the percentage modification of initial OEE" [9, p. 236-238] [11].

$$E_{woee} = \frac{\Delta W\%}{\Delta OEE\%} = \frac{\frac{\Delta W}{W_0}}{\frac{\Delta OEE}{OEE_0}} = \frac{\Delta W}{\Delta OEE} \cdot \frac{OEE_0}{W_0} \quad (3)$$

where:  $\Delta W\%$  - percentage modification of waste (stocks) between the initial planning and current status;  $\Delta OEE\%$  - percentage modification of OEE between the standard level and the current level.

In extended, *Waste (stocks) elasticity of losses (WEL)* approaches the impact of all losses on waste (stocks) variation, and further on the unit cost of products.

The seventh step, *daily MCI management*, focuses on the deviations from MCI targets and on the fast approach of these variations using different problem solving techniques (especially the A3 technique) to continuously support the strategy of cost at the shop floor level. The basics of daily MCI management are:

- ✓ *the basic principles and responsibilities for daily MCI management* ("clarity, transparency, and ease of understanding the current status of the costs corresponding to losses and waste; the concise and friendly presentation of information; ease of identification of action alternatives to reduce or eliminate the deviations to MCI targets; continuous implication of all the people; decision making based on data and facts; and cooperation between local teams and teams across functions") [9, p. 239].
- ✓ *management branding (MB) for MCI or contextual managerial behavioural identity* (Posteucă, 2011) which approaches in seven steps: analysing the undesirable behaviour of managers and choosing the behaviour to be improved, establishing the team and defining the objective of improvement; implementing the actions of isolation of undesirable behaviours of managers in the short run; defining the phenomenon that created the undesirable managerial behaviour, action plan to correct undesirable behaviour, verification of behaviours over time and their standardization, plan of solutions expansion for contextual undesirable behaviours to other managers [9, p. 240-244].
- ✓ *daily MCI management process* refers to the process of establishing the priorities for manager tasks from the perspective of MCI targets and thus the targets for losses and waste and it is based also on PDCA cycle, like the entire MCPD system.

In conclusion, the daily control of MCI targets is the key of the MCPD system because it provides monitoring and rapid correction of any deviations from MCI targets through a system of management escalation from bottom up and top down [13].

#### 4. CONCLUSION

So MCPD is not a method of cost calculation. The MCPD system is for determining the target and means to continuously achieve MCI to ensure a level of competitive productivity. Through the continuous improvement of costs related to losses and waste for each product family cost, the impact of MCPD system is on the entire production system of the company and thus on the improvement of production lead time,

material stock, finished products stock, material handling, and overtime.

So, the interest for MCPD from top management of production companies refers to the need to translate the strategic objectives of continuous reduction of unit costs for existing products within product families in order to maintain a continuous level of competitiveness in price, during annual activities of systematic and systemic productivity improvements, by establishing targets and means for each cost structure and through total involvement of all employees at all levels of the company.

The MCPD system provide a unique approach for the managers who are seeking new ways for increasing productivity and profitability to increase the competitive level of their manufacturing company.

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