COST DEPLOYMENT IMPLEMENTATION: A CASE STUDY

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ABSTRACT

The paper deals with modern managerial and accounting tools and specifically with cost deployment, a key pillar into the World Class Manufacturing programme designed by FCA. After presenting a Literature review on the topics of World Class Manufacturing, Managerial accounting and Cost Deployment, which addressed this study, the work sets methodological framework of research, underlining the gaps in the current Literature, which provides few evidences of the actual results and benefits of a cost deployment system.

The research was conducted through a case study presenting the implementation of a cost deployment system into a large manufacturing firm in the North-West of Italy, analysed through the steps suggested by FCA.

Data collection was carried out in collaboration with the operations controller of the plant. Several semi-structured interviews provided more evidences to support conclusions.

This company was chosen because the implementation of the cost deployment tool was on an early stage, this made possible to follow-up the entire process.

The present research helps understand the effectiveness of this tool, which supports manufacturing firms in reaching higher levels of quality, output and overall efficiency in their production systems.

In addition, the paper gives evidence of the benefits tracked by controlling thanks to the System even at an early stage of development and underlines the major differences with the theoretical framework set in previous studies.

Keywords: Cost Deployment, World Class Manufacturing, Management Accounting, Cost Accounting, Case Study

INTRODUCTION

Historically manufacturing companies have striven in order to achieve a competitive advantage either reducing costs or having different products from competitors.

Ford's assembly line marked a crucial step toward a more efficient industry model from the British one of the late Nineteenth Century and helped America gaining a Manufacturing hegemony that lasted more than 60 years.

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The USA lost their leadership during the Eighties though, due to lack of innovation in their production systems and to a more challenging economic scenario.

As a matter of fact, Japanese Manufacturing model gained popularity during the second half of the twentieth Century: many studies pointed out how Japanese producers had been able to reduce costs, increase efficiency of their equipment and have less quality defects at the same time.

As the secret of Japanese success was unveiled, western manufacturers began to adopt those production techniques that, by the end of the Eighties, were gathered together under the phrase "World Class Manufacturing", meaning the achievement of a state-of-art level both in logistic and productive cycles.

Nowadays lots of different companies adopted and customized World Class production models introducing different tools, reporting standards and best practices: FCA introduced its own Production System in the early 2000s, comprehensive of a specific "Cost Deployment" practice.

This tool was developed alongside a Japanese guru on the matter and aims to link the plant efficiency and quality performances to transformation costs, identifying wastes and losses.

Moreover, Cost Deployment developed by FCA provides tools to set priorities in choosing the improvement projects into the plant, based on a benefit-loss analysis and on the economic return calculation.

Finance and controlling area become the engine of the improvement helping the management into its decision process.

The Company chosen for the case study is part of a large American conglomerate and produces brake pads in its Italian plant.

In 2014 the new Management decided to adopt the World Class Manufacturing Programme developed by FCA. In the following period the first activities related to the Improvement programme began and in late 2015 a first cost deployment edition was prepared as well.

The paper focuses on this company as the Cost Deployment method was at very early stage of development and it was possible to observe a proper implementation through all its steps.

Focusing on such an early stage helped the research understanding what the main implications of the tool are and how the organization responded to the new system.

At the same time this allowed to provide a judgement on the results brought by Cost Deployment pillar.

The research presents some limits: first of all, it represents a single case study and the generalisation of results should be further tested by comparing this case with other companies.

Furthermore, this first sep might be useful to build a more complete theoretical framework on the topic.

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The remainder of the study is organised as follows: in paragraph 1 a brief literature review is presented, in section 2 methodology and research design are described, paragraph 3 instead presents findings, while comments and discussion follow that section and finally the conclusions are presented.

1. LITERATURE REVIEW

"World Class Manufacturing" phrase was coined by several authors referring to the set of practices in operations management that could lead any manufacturer to an excellence level (Hayes and Wheelwright, 1984; Schonberger, 1982, 1986). Many of these practices were adopted from Japanese manufacturers who originally developed them.

Starting from those studies, others discussed the possibility to achieve simultaneously different competitive advantages through the adoption of World Class Manufacturing Flynn (1996; 1999).

On the other hand, Womack et al. (1990) depicted birth and rise of the Toyota Production System (TPS) and studied the reasons behind its success. Yamashina (1995; 1996) focused on a peculiar aspect of Japanese manufacturing strategies, total productive maintenance.

As FCA decided to develop its own World Class Manufacturing programme, many researchers studied it during the last decade: for example (De Felice et al. 2013) focused on a concrete case study in one of FCA's plants; Chiarini and Vagnoni (2014) tried to make comparisons between the Fiat Auto Production System and TPS highlighting similarities and major differences. They underlined the innovation of fully developed set of managerial practices that allow to involve the entire organization.

Cipriani et al. (2014) investigated the impact of the introduction of a World Class Manufacturing programme in terms of cultural changes inside the company. At the same time, they carried out a survey involving the plant workforce.

Several researchers dealt with the topics of cost accounting and management accounting investigating the birth and the evolution of these matters (Scott, 1931; Littleton, 1933; Garner, 1954).

Armstrong and Hopper (1991) offer an interesting analysis concerning the role of labour cost in the development of management accounting systems.

Moving forward, Johnson (1981) underlined new emerging tools in cost and managerial accounting such as Activity Based Costing and Balanced Scorecard.

Chan (1993) provided evidences of Activity based Costing describing the implementation of an ABC system into a context other to manufacturing as a hospital.

Despite these new methods developed by companies and researchers, Johnson and Kaplan (1987) highlighted how managerial accounting lost its relevance and Cooper and Kaplan (1988) argued that cost accounting could potentially provide misleading results.

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Kaplan (1984:1; 1984:2) argued that Managerial accounting systems should have gone towards a better understanding and representation of Manufacturing performance. In this sense, Jazayeri and Hopper (1999) provided a case study about the relationship of the Management Accounting system and a World Class Manufacturing programme.

Yamashina (2000) highlighted a rather similar concept and first introduced a new method named "Manufacturing Cost deployment" in order to achieve a better measurement of operations performance (Yamashina and Kubo, 1999; 2002).

Their method embraces the typically Japanese concept of continuous improvement; it does not only help mangers to identify costs associated to losses and wastes but it also provides rational criteria to choose new investments in the plant. In this sense, also Vikram et al. (2015) underline the benefits that a lean strategy can bring to an organization.

Cost deployment became a breakthrough and several companies adopted it: FCA decided to customize its own system into a general World Class manufacturing framework (IlSole24Ore, 2010).

Silva et al., (2013) studied FCA's cost deployment system; Garbe and Olausson (2014) provided a similar case study based on a plant of Volvo group.

Kirkham et al. (2014) investigated how companies assess and choose the improvement projects in relation to their size.

Recently, Posteucâ and Zapciu (2015) discussed a method implemented to reduce the potential losses of new products already during the development phase. Their method shares many similarities with cost deployment techniques.

Moreover, Carmignani (2017) showed an application Cost Deployment as part of a "Scrap Value Stream Mapping" process.

This research fits into this framework and, in particular, it focuses on providing tangible results of an early developed cost deployment system, which is also described in its implementation.

2. METHODOLOGY

Research design

The case study describes the implementation of cost deployment inside a large manufacturing plant in the North-West of Italy. The plant is a part of the Italian branch of an American conglomerate since the eighties. The core business of the plant is the production of brake pads. Around 700 workers are involved in operations and the productions of brake pads.

The choice was made because one of the authors had the opportunity to spend several months in the plant alongside the controller: this represented the starting point of our analyses, this topic will be carried over comparing the findings of this paper to results of different companies, firms and plants.

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In addition, the choice is motivated by the fact that cost deployment was on an early stage of development.

The case study was built analyzing different areas of the company and their involvement in implementing cost deployment pillar.

This was necessary as many areas take part in the cost deployment system although the controlling area had a preeminent role due the knowledge of financial items.

Given these premises, data were collected interviewing managers and directors from operations, maintenance, quality, technologies and logistic areas. In addition, a collaboration was established with the controlling manager of the plant who was in charge of the cost deployment pillar. This helped understanding and following up the entire process. By the end of the research period it was possible to observe the output of the system implemented.

Data collection and procedure

The case study was conducted over a period of nine months from June 2016 to February 2017. During this time, semi-structured interviews of an open-ended nature represented the main method of the research.

Many departments of the plant were involved in the research as they were collaborating with the industrial controller in order to implement a cost deployment edition.

At the same time the continuous collaboration with the plant controller made possible to carry over an in-depth analysis on the procedures and tools adopted by the method.

Main goals of the present case study are to understand how the cost deployment method is implemented and what are the main results over the period, assuming that differences from the model developed in the early 2000s may emerge.

Moreover, the study aims to formulate research questions by problematizing some dominant assumptions in existing research (Davis, 1971). In particular, the main research questions are the following:

- *Research question 1*: how is a cost deployment implemented in an actual plant and what are the main differences compared to the theoretical framework set by Yamashina (2002)?
- *Research question 2*: what are the main short-term results and the main critical aspects?

This approach would support a more reflective-scholarly attitude (Abbott, 2004) and consider a different epistemological approach.

In this case the epistemological approach is that of induction because it finally helps reach a verdict and elaborate a theory that derives from a number of testable consequences that have been verified.

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The focus was set on this topic because few authors until now studied the results that a proper cost deployment system can bring even in short term. Silva et al. (2013), for example provided an example of the implementation process but they did not examine the actual benefits in terms of cost reduction.

3. FINDINGS

The interviews carried out through the entire organization and the continuous collaboration with the industrial controller helped understanding how the entire cost deployment process was implemented in the plant.

First, it is necessary to underline that cost deployment is part of a larger programme called "Fiat Auto Production System" which requires the adoption of a set of methodologies to reach a "World Class" level in manufacturing.

Twenty pillars compose the entire programme, divided into ten defined as technical and ten defined "managerial".

The ten technical pillars are:

- Safety – which aims to enhance the safety and hygiene level in the plant in order to reduce work related injuries;
- Cost Deployment – a proper tool to understand the economic value of wastes and losses in the production process and to reduce them;
- Focused Improvement – which attacks wastes and losses starting from the analyses carried out by cost deployment pillar;
- Autonomous Activities (split into Workplace organization and Autonomous Maintenance) – which aim to reduce productive cycles through a more ergonomic workplace and reduce breakdowns thanks to activities carried out by operators;
- Professional Maintenance – its first goal is to prevent breakdowns and take them to level zero;
- Quality Control – which aims to reduce quality defects;
- Logistics and Customer service – a set of practices to reduce the working capital and optimize the logistic flow;
- Early equipment and Product Management – which aims to integrate the design of products, equipment and assembly lines inside the plant;
- People Development – its main goals are to allocate human resources and manage know-how inside the company;
- Environment.

The ten managerial pillar are: Management Commitment; Clarity of Objectives; Route Map to WCM; Allocation of Highly qualified people to Model Area; Commitment of the organization; Competence of

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Organization towards improvement; Time and Budget; Level of detail; Level of Expansion and Motivation of operators.

These managerial pillars have a key role in involving the entire organizations, from the the top management to shop floor and clarifying the objectives that everyone in the plant has to achieve.

On the other hand, each technical pillar has peculiar tools and practices to accomplish its tasks. Moreover, seven phases of implementation – defined as steps – compose every pillar.

As figure 1 shows, the steps are divided into reactive, preventive and proactive: as more experience is acquired by the organization, more detailed actions can be undertaken to prevent wastes and losses.

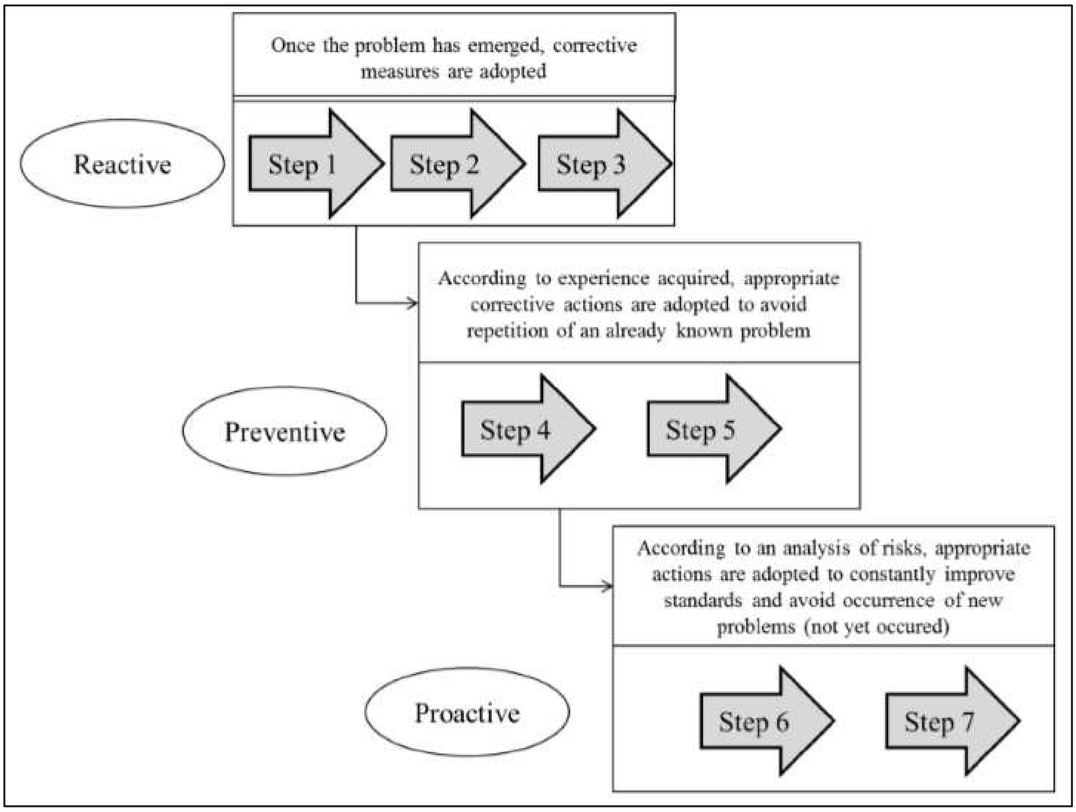

Figure 1. The seven steps of the Technical Pillars. Source: De Felice et al. (2013)

Cost Deployment – as formalised by FCA – makes no exception and follows the same path of implementation of the other pillars through those seven steps. A matrix is prepared as output of (almost) each step.

The FCA method presents many similarities with the method first implemented by Yamashina and Kubo (2002), and some new peculiar features.

Hereafter this section deals with implementation of the method undertaken to understand which part of the costs in the plant are associated to wastes and losses.

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A key success factor for an accurate cost deployment is an exhaustive data collection that forms the data base for all the analyses. We had the opportunity to understand how data collection is carried out in the plant:

- Efficiency losses on machinery and equipment are collected in real time thanks to the information system linked to machineries and equipment;
- Scraps are registered automatically from the machines (presses, grinding machines…) but the causal attribution (i.e. the reason of the scrap) is done by operators at the end of each shift;
- Breakdowns are registered at the end of every shift, in addition to that Emergency Work Orders (so-called EWOs) are filled in describing all the breakdowns;
- Not added value activities are estimated by the technical department;
- Energy losses are measured on the model areas;
- Absenteeism and labour defections are register by Human resources department.

The first step of cost deployment requires the definition of the transformation cost, i.e. the costs associated to modifications of the product in the assembly line.

Consequently, the transformation cost includes direct labour, part of the indirect labour (e.g. maintenance engineers), some variable overheads (e.g. utilities), some fixed overheads.

On the other hand, other costs are excluded: for example, the cost of direct material, the administrative and general expenses.

Thanks to this first step, the cost deployment pillar is able to understand which part of the total costs in the plant contributed to the productive process and create added value: about 25% of the total costs in the plant was included into the WCM perimeter. The remainder (excluded) were mostly due to direct material and Administrative expenses.

As the transformation cost is defined the pillar can move on: the second step required the construction of the “A-matrix” and a first analysis on the losses inside the plant.

More in detail, the A-matrix represents the allocation and the severity of those losses in the plant.

In fact, the A-matrix is fulfilled twice: first of all it is given an assessment about the severity of the losses (so-called “A-matrix” quality), then it is calculated the occurrence of the same losses in the assembly line thanks to data collection (so-called “A-matrix” quantity).

After this step, the organization becomes aware of the places where most of the losses occurred and which were the worst: in particular breakdowns, quality defects and scraps revealed to occur more often.

So, it was possible to prepare the third step and the B-matrix which allows to study the relation between causal and resultant losses, i.e. how a loss can influence the rest of the production process and cause more losses in terms of production delays, scraps and so on.

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At this stage, losses analyses are complete and it is possible to start the attribution of a cost element to each of these losses.

Therefore, the fourth step began and the C-matrix was prepared. Starting from the results of the previous steps it had been possible to link resultant losses to the respective causal losses.

After that, thanks to the elaboration of cost drivers and more in-depth analyses, it was possible to transform each loss into a cost.

The output of this step is a matrix that allows to understand how much of the transformation cost is lost or wasted. The amount individuated was about 45%.

Most of the losses inside the plant were due to breakdowns (27% of the total), not-value added activities (23%), quality defects (16%).

Thanks to a detailed data collection the C-Matrix reveals the allocation of the losses regarded as costs:

- On every single line;
- On every machine;
- divided by type.

This step represents the foundation of the following analyses and gives a first glance at the prioritization of measures and projects applicable to reduce losses and gain efficiency.

The fifth step requires to develop the so-called "D-Matrix". This tool utilizes the loss stratification as a starting point to define the projects and to set priority level.

Causal losses from C-Matrix are analyzed and related to the possible tools to eliminate them, to the KPIs that are going to improve thanks to the projects and to the easiness of each project.

These are then summarized by an ICE (Impact-Cost-Easiness) analysis. Every project received a score based on:

- the impact it potentially had in terms of loss reduction (cost savings);
- the cost – or the investment – of the project itself (e.g. an improvement project may need new tooling);
- the easiness of the implementation of the project itself.

This ICE analysis stands in line with what observed by Kirkham et al. (2014) about large manufacturing firms and the methods to set priorities of interventions.

When D-Matrix was completed, it identified enough projects to reduce by 9,4% the entire transformation cost through loss reductions.

As mentioned the plant had by that moment a proper priority level to undertake losses reduction actions in an economically sound logic.

Moving on to step six, E-Matrix is prepared. This matrix is filled in with the projects actually implemented in the plant during the period.

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Project cards are prepared to keep track of the several projects started during the year. Every project is linked to its project card, which contained information about:

- the type of project and its progress (thanks to the PDCA cycle);
- the type of loss attacked and the related KPIs;
- the authorizations of the plant director and the plant controller.

The project card mechanism allows controlling area to keep all the projects under control and to prepare a first forecast of the yearly savings.

More than one hundred projects were carried on during the period and the (yearly) saving forecast was set at 8% of the transformation cost.

The remainder step concluded the cost deployment process. The last two matrices (F-matrix and G-matrix) compose step number seven.

F-matrix collected all the savings coming from the projects started and concluded: again, project cards flow revealed useful to estimate those savings.

The controller could check monthly the status of every project undertaken (Plan-Do-Check-Act) and certify the savings calculated from the KPIs associated.

In fact, once the savings were certified by controlling area, they were entered in the F-matrix.

By the end of the year, F-matrix covered 7,8% of the transformation cost.

The second matrix of step seven represents the budget for the forthcoming year. It collected different types of saving, specifically coming from:

- carryover of project that are meant to last over the year;
- expansions and extensions of on-going projects in different areas and replicable in others;
- new projects that aim to reduce losses not yet attacked.

The savings expected for the coming period were about 8,3% of the transformation cost.

The cost deployment process does not stop after the loop is completed, but starts again to investigate more in-depth costs trying to individuate on hidden wastes and losses.

This activity requires more detailed data collection, analyses and collaboration from every part of the organization.

Usually the cost deployment pillar re-starts from the fourth step, editing C-matrix and so on. Some of the matrices, e.g. E-matrix and F-matrix, are updated monthly.

4. CRITICAL COMMENTS AND DISCUSSION

As showed by Silva et al. (2013), the implementation took place through the seven steps: each step gave as output a quantitative analysis of the data collected and elaborated.

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The process showed some peculiarities compared to the conceptual framework designed by Yamashina and Kubo (2002): the implementation of step 6 and step 7 allows to track actual savings and make forecasts for the periods to come.

In this sense, the method observed in the case study, showed some improvements compared to the one described by Garbe and Olausson (2014) too, as G-Matrix was implemented.

Cost deployment revealed to be a useful tool in the plant.

The main advantages of this method are:

- a more effective and conscious control of the cost items related to the productive process;
- an involvement of the controlling area which is forced to pay more attention to all the departments (and pillars) involved in World Class manufacturing programme;
- the economically driven choices of the projects through the cost-benefit analysis;
- a continuous control over the improvement projects carried out in the plant and a better calculation of the savings.

As showed in Findings, the benefits from projects implemented thanks to priorities given by cost deployment in an economic sound logic were consistent.

In addition to those cost benefits, Cost Deployment can make all operators more aware of the impact they have on the productive process. Giving cost values to losses registered magnifies every reduction in terms of breakdowns, scraps and so on, helping them to understand that they are giving a tangible contribution.

A key success factor is, therefore, the involvement of the organizations: the case study supports findings by Cipriani et al. (2014). WCM pillars are often underestimated by many figures in the organization at an initial stage of development.

This revealed to be one the most critical aspect of the implementation, as many workers did not understand the importance of the methodology.

5. CONCLUSIONS

The research involved an in-depth study of cost deployment implementation in a large manufacturing plant: the paper presented the characteristics of the World Class Manufacturing programme that includes it, described the process through its steps and observed the results.

Findings underline differences between the method adopted by the company observed – in line with the implementation described by Silva et al. (2013) –: the theoretical framework set by Yamashina (2002) had been updated and enriched with new tools to choose rationally the improvement projects and keep them under control.

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The methodology can be adopted by manufacturing firms willing to improve their understanding of cost dynamics inside the plant and to identify more clearly waste and losses.

In recent years indeed cost deployment practices improved, allowing remarkable results in terms of cost benefits, as the paper proves.

This last element helps underline the limitations for the present study. First of all, it focuses only on one specific plant: further analyses will be conducted in the future, by comparing this case with other firms.

In addition, empirical results might help elaborate a new conceptual and theoretical framework that might have important practical implications for managers and entrepreneurs.

Researchers and academics may also find interesting elements to develop and further the study on the topic.

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