COST REDUCTION OPPORTUNITIES IDENTIFICATION BASED ON A TREE MAPPING DIAGRAM APPLICATION IN AN AUTOMOTIVE SECTOR INDUSTRY

Autores:

Alexandre Kenji Yamane
UNIFEI
alexandre.yamane@yahoo.com.br

Luis Guilherme Azevedo Mauad
UNIFEI
mauad@unifei.edu.br

Rafaela Guimarães Leão Ribeiro
UNIFEI
rafaelaleao2@gmail.com

Área temática:
Gestión de costos y administración del valor

Metodología aplicada:
M2 – De caso /Estudio de campo

Medellín, Colombia, Septiembre 9, 10, 11 de 2015

Convocan:

Instituto Internacional de Costos
UNIVERSIDAD DE ANTIOQUIA
FACULTAD DE CIENCIAS ECONÓMICAS
DEPARTAMENTO DE CIENCIAS CONTABLES
RECOGES
RED COLOMBIANA DE COSTOS Y GESTIÓN

ABSTRACT

Automotive sector high competitive demands a continuous cost reduction over all supply chain. Survival and growth of these companies depend directly on operational excellence of improvement projects management. Several project management methodologies are usually employed to achieve all targets in an efficient manner. However, opportunities mapping identification and priorities selection are essential steps on this process. Tree mapping diagram application allows a more precisely operational costs deployment overall the company with a deeper and detailed analysis by each cost origin classification. This tool employment collaborated to identify highest critical ways of costs in order to better prioritize most significant improvement projects, resulting on cost reduction gain maximization and resources employment minimization in an automotive sector industry.

Key Words: Cost reduction, improvement projects and tree mapping diagram.

1. INTRODUCTION

After the First World War all automotive industries have changed and transformed due demand increase and lack of products quality, that resulted on several quality technologies improvements. Then, quality basic concepts have been developed and applied over different locations. In the beginning of Twentieth Century, automotive industry revolutionized the work method by eliminating the handmade and developing the mass production concept, setting to the FORD era. High volume production and low cost have been the big benefits of the productivity increase due the machines aligned and connected by a conveyor, but mass production have faced deficiencies and difficulties after new incomers raised in this market. The Japanese brands started a new production model that was effective enough to compete directly with the North American and Europeans market domination (Gorender, 1997).

Automotive market is well known by the constant seek for innovation and manufacturing optimization in order to reduce costs and be more competitive (Fujimoto, Takeish 2001 apud Carvalho, 2007). This improvement process demands a strategic mapping and targets deployment organization in improvement projects management overall the business. As investment budgets and resources are limited in this sector, this improvement projects management could be considered a competitive differential.

> *According to Archer, Ghasemzadech 2007 and Amaral 2009 apud Dutra (2012) "as a part of competitive advantage strategies, organizations have changed their focus from operations to project management. Besides of being a deeply developed area, project management normally exceed their budget, delay and fail on specific goals achievement. A main goal of this context is to develop the capacity of select which projects should be implemented and then, prioritize them in order to maximize the gain to the organization".*

One of the main difficulties of the companies is to effectively allocate resources in the best opportunities to reduce internal costs. Therefore, a lack of organized and standardized method results on waste of time and money invested on projects that are not the main priorities on cost reduction. It's possible to find several tools to select and prioritize projects, such as the Pareto Diagram, Tree Diagram and Fault Tree Analysis (FTA). Based on that, the present article has the main goal to evidence the importance of

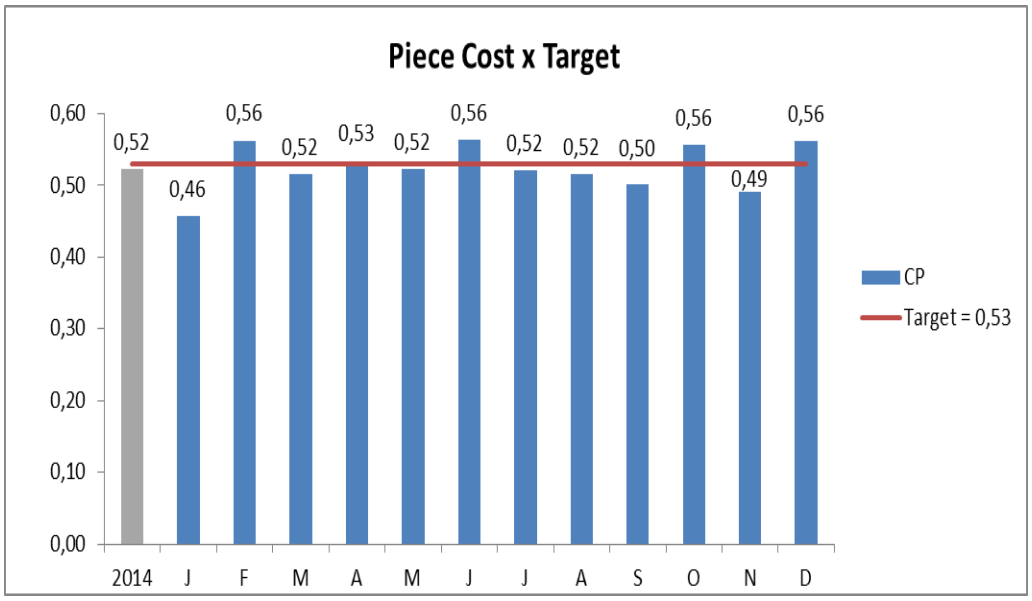
improvement projects application on cost reduction by Tree Diagram application to select and prioritize the decision process. The case study of this research was applied at an automotive industry company and had the final aim to reduce costs by improving resources employment.

2. METHODOLOGY

The methodology applied in this article was a quantitative research. According to Denzin, Lincoln 2005, Neves 1996, Hayati, Slee 2006 apud Terence (2006) "in organizational studies quantitative researches allows the measurement of opinions, reactions, behaviors and attitudes in a universe through a sample that represent statically". Besides, the article is considered an action research which practitioners seek to achieve effect transformations in their own practices. (Brown, Dowling, 2001 apud Tripp, 2005).

This study approached a descriptive research of one of the production areas of the organization that was facing financial difficulties. Main Key Performance Indicators (KPIs) such as Return On Sales (ROS) and Return on Capital Employed (ROCE), were out of the targets in the Balanced Scorecard (BSC). The BSC plays an important role in the strategic management process of modern companies, helping manage to clarify and obtain consensus on strategic objectives, assisting them in communicating the chosen strategy, and consequently aligning the efforts of both individuals and organizational units (Kaplan and Norton 1996, apud Barnabé and Busco, 2012).

Financial Perspective Key Performance Indicators (KPIs) out of the targets resulted on piece production cost close to the break-even point. Based on this situation, the high management of the company raised three different focuses: increase price by negotiation with main customers, increase volume of more profitable products and reduce internal operational costs. This sector has too many constraints to increase freely the product prices due to long-term contracts and due the dependence of production volume from car manufactures demands that also depend on market demands. Therefore, this article will focus only on the operational costs reduction by improving the project management.



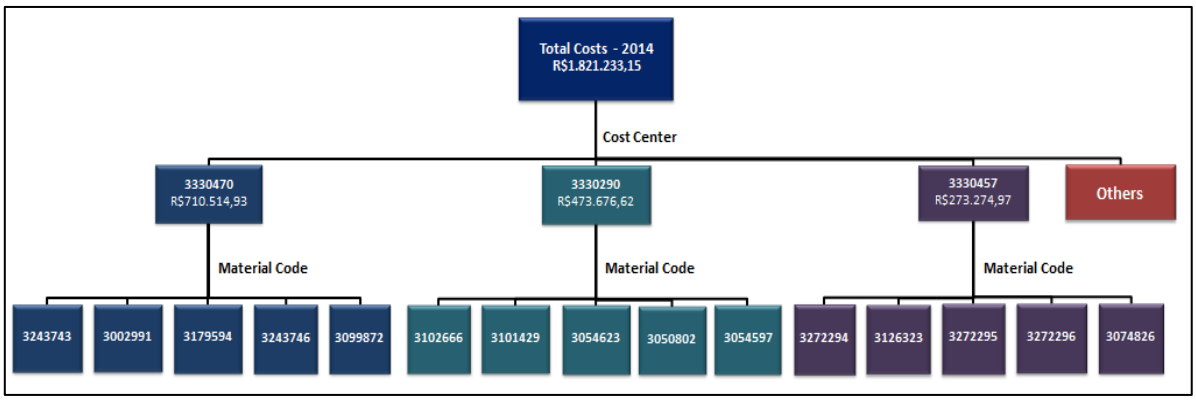
Picture 1. Piece Cost x Target

The piece cost indicator out of the target, as showed in Picture 1, was deployed by the production cost stratification and it was identified that the main focus is the high material costs.

3. COSTS DEPLOYMENT BY TREE DIAGRAM APPLICATION

Tree diagram is a tool and method that by visual depiction of relationships has the aim to map all problem deployment from the overall target up to the root cause. This application drill several levels as sub causes and sub effects of the problem, resulting on a graph close to an organizational organogram or genealogic tree (Baldam, Valle and Rozenfeld, 1966).

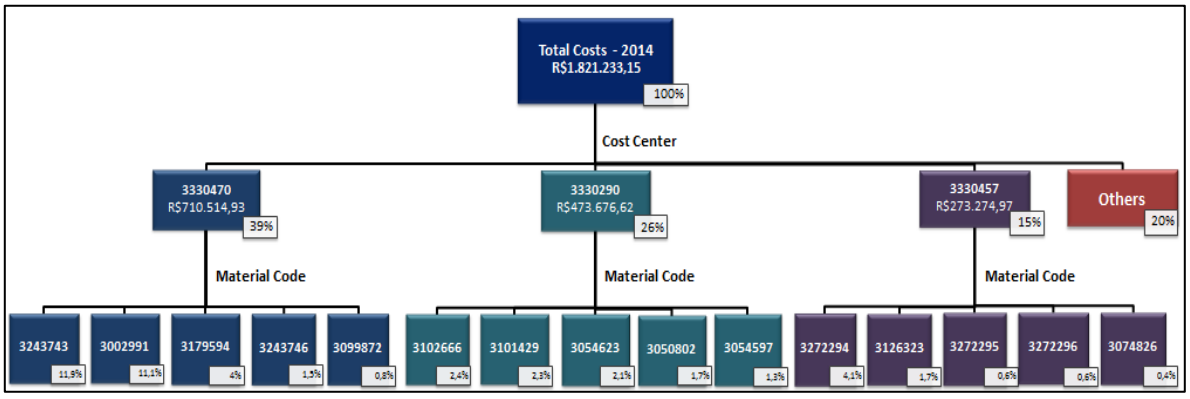
Based on the problem focus definition to reduce material costs of the manufacturing area, it was mapped all types of material costs and then, they were organized in a tree diagram by cost center classification and description of each material with data of one entire year (2014). Thereby, main cost center with the main material costs (Material code represented) were identified according to the picture 2.



Picture 2. Tree diagram application

This cost mapping deployment allowed the Pareto Diagram application. Pareto Diagram is an information classification method to identify more impact or importance items. The ABC curve or 80-20 was inspired in the Vilfredo Pareto economist theorem and basically, the method consists on problem causes and effects classification in two big families, when 80% of the consequences correspond to 20% of the causes (Baldam, Valle and Rozenfeld, 1966).

In the presented study, all material cost centers have been classified by the Pareto Theorem and each contribution % was applied in the tree diagram as presented in the picture 3. The same method was applied to the next mapped level and it was applied each material cost contribution to the material codes in the tree diagram.



Picture 3. Material Cost Centers deployed with Pareto Theorem

Table 1 below presents the summary of the main material costs contribution classification. Based on each material individual contribution for each material cost center

and each material cost center contribution for the overall material costs, it was possible to identify each material individual contribution for the overall material costs.

Material Classification	Material Code	Cost	Cost Center	Overall Material Costs
Chemical	3243743	R$ 217.167,70	30,6%	11,9%
Chemical	3002991	R$ 201.943,29	28,4%	11,1%
Abrasive	3272294	R$ 78.789,29	27,0%	4,3%
Chemical	3179594	R$ 72.732,14	10,2%	4,0%
Packing	3102666	R$ 41.886,65	9,2%	2,3%
Packing	3101429	R$ 40.317,57	8,9%	2,2%
Packing	3054623	R$ 35.997,46	7,9%	2,0%
Oil	3126323	R$ 32.811,48	11,3%	1,8%
Oil	3050802	R$ 28.973,57	6,4%	1,6%
Chemical	3243746	R$ 27.899,57	3,9%	1,5%
Other	3054597	R$ 22.906,53	5,0%	1,3%
Other	3099872	R$ 14.204,51	2,0%	0,8%
Abrasive	3272295	R$ 11.655,00	4,0%	0,6%
Abrasive	3272296	R$ 11.379,37	3,9%	0,6%
Abrasive	3074826	R$ 8.655,24	3,0%	0,5%

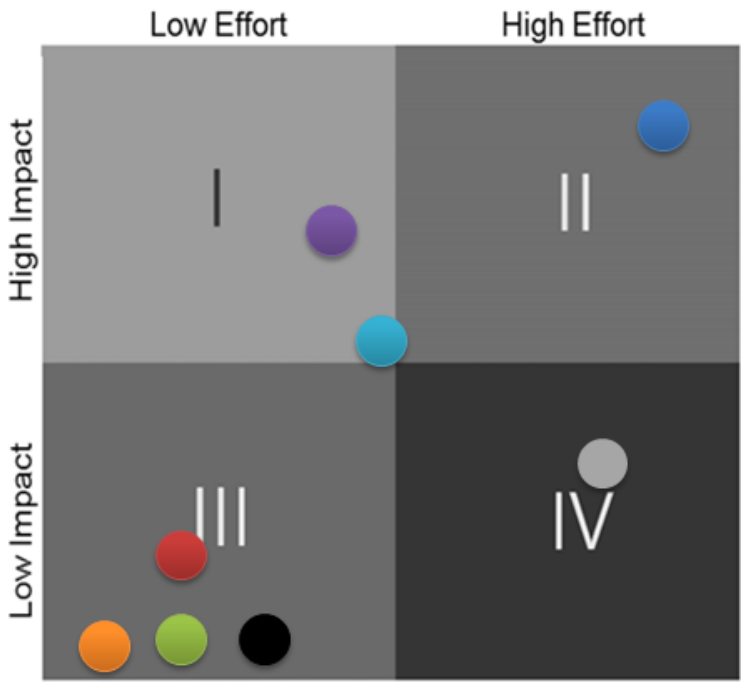
Table 1. Material costs contribution

All team members responsible for the manufacturing area have followed all mapping process and could contribute deeply in the Brainstorming phase. The brainstorming is a process that aims creativity stimulation and classifying ideas generation to further organization (Dellareti, 1996).

This brainstorming process was applied to generate improvement projects ideas focusing on material cost reduction that more contribute to the overall material costs. After idea generations next step stablished was the selection and prioritization definition. The impact classification was defined based on the potential cost reduction opportunity of each project and the effort classification was defined based on the constraints and needed resources evaluation. The picture 5 below shows all potential improvement projects already classified in the Impact and Effort Matrix.

Material Classification	Project List	Project Identification	Potential Saving
Chemical	Reduce 30% of chemical products		R$ 21.539,00
	Improve the output in 35% of tin line		R$ 37.500,00
	Eliminate tin operation in the products		R$ 135.000,00
	Reduce in one day the tin operation		R$22.000,00
	Reduce 20% the application of tin		R$ 83.000,00
Abrasive	Reduce 15% of cost with grindstone		R$ 80.000,00
Packing	Standardize and reduce mix of packing		R$ 18.560,00
Oil	Reduce 5% of consumption and oil expenditures in the processes		R$ 57.980,00

Picture 4. Projects from brainstorming



Picture 5. Impact and effort matrix

Based on the Impact and Effort Matrix, potential improvement projects with the highest impact and lowest effort were selected and prioritized for the team execution. The main project selected within this condition was to reduce 20% the application of tin and reduce 15% of cost with grindstone.

4. PROJECT MANAGEMENT

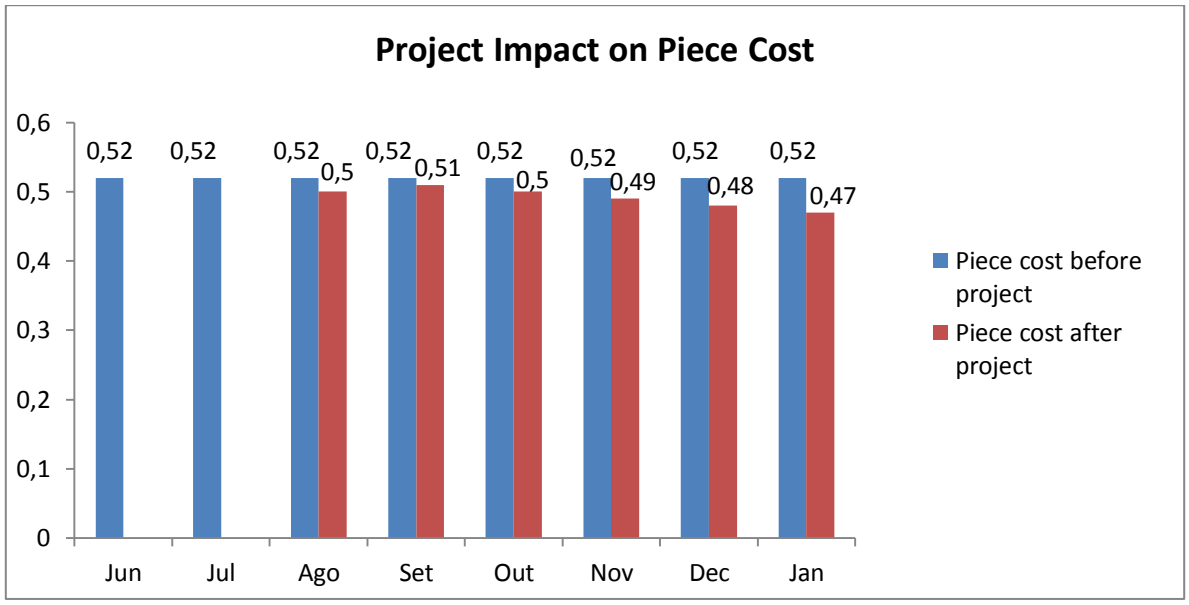
The project selection is an important step as concepts, tools and techniques should be efficient applied to balance stakeholder's expectations with available resources in order to maximize project success potential achievement (Rabechini Jr, Carvalho and Laurindo, 2002). As most of organizations have more potential projects than capacity to implement them, Archer and Ghasemzadeh, 1999 apud Castro and Carvalho (2010) state that the portfolio selection involves the simultaneous comparison of an amount of projects in a particular dimension to obtain the desired sequence of projects.

The projects need to be prioritized according to their importance and contribution for the organization strategy in comparison to other projects. The priority of each project can be changed with each new evaluation based on environment changes (Castro and Carvalho, 2010). Normally, besides projects selection phase importance, the definition and allocation of resources are also an important and difficult decision for the organization. The biggest obstacle for the companies is the availability and quality of necessary resources. Therefore, the strategy and allocation of resources in the projects should be intimately connected. While resources are not efficient allocated, the strategy is only words. On the other hand, if the strategy is focus in certain markets, products or technology, then most of resources should be focus in the same markets, products and technology (Castro and Carvalho, 2010).

The selected projects have different sizes, strategy focus, implementation constraints and variety of risks. Therefore, the project management is considered as a complex activity and also requires a deeper portfolio monitoring and control. Lean Six Sigma methodology and PMI are applied to manage improvement projects in the case studied company. After all action plan is executed by project, effectiveness is checked

monthly based on the comparison between the potential saving calculated in the project chart definition and the real cost saving. This information allows the continuous improvement department consolidates a monthly report to deploy all project effectiveness for all project owners and stakeholders.

Based on all selected projects potential savings and expected conclusion date, it was possible to forecast the impact on the piece cost indicator. The project "To reduce 20% of tin plating" expects to be finished on July and the project "To reduce 15% of grindstone cost" expects to be finished on November. The chart on picture 5 shows the impact of both projects cost saving on piece cost indicator. The expectation is to achieve the 0,5 BRL piece cost target for this product.



Picture 6. Piece Cost Indicator Forecast

CONCLUSION

Automotive sector demands a continuous products cost reduction for all industries to assure their competitiveness. Manufacturing improvements are coordinated by project management and tools application. This article presented a sequence of tools applied to maximize resources employment on improvement projects coordination focused on material cost reduction in an automotive industry.

Tree mapping diagram was applied to map and deploy all material costs in different levels of costs. For each mapped level Pareto concept was applied to identify more representative material costs to be analyzed. Based on that, main opportunities were selected to be analyzed by process experts through brainstorming application, and then, Effort and Impact Matrix use to prioritize opportunities with their highest cost saving reduction impact and lower effort needed as investment, customers constraints, process complexity or leadtime.

This methodology application allowed the company managers to apply less investments and resources focused on the main material cost reduction opportunities. Based on the potential cost saving and expected conclusion of each project, it was possible to define a piece cost reduction within the expect target by the stakeholders. The importance of this kind of study is to share practices and present the feasibility of using these tools in a complex automotive sector environment that can be applied in any situation close to the presented in this article.

REFERENCES

BUSCO Federico. "The causal relationships between performance drivers and outcomes", Journal of Accounting & Organizational Change, Vol. 8 Iss 4 p. 528 – 538, 2012.

CARVALHO, Enéas Gonçalves de. Inovação tecnológica na indústria automobilística: características e evolução recente. Econ. soc., Campinas, v. 17, n. 3, p. 429-461, Dec. 2008.

CASTRO, Henrique Gonçalves de; CARVALHO, Marly Monteiro de. Gerenciamento de portfólio de projetos: um estudo exploratório. Prod., São Carlos, v.17, n.2, p.283-296, 2010.

DUTRA, Camila Costa. Modelo econômico-probabilístico para seleção e priorização de projetos. Porto Alegre, p. 14-118, Dec. 2012.

FILHO, Edmundo. Abordagem quantitativa, qualitativa e a utilização da pesquisa-ação nos estudos organizacionais. Prod., Fortaleza, Vol. 22 n. 2, p. 201-210, 2006.

GORENDER, Jacob. Globalização, tecnologia e relações de trabalho. Prod., São Paulo. vol.15, n.1 p. 310-361, 2005.

OLIVEIRA, José Augusto de et al. Um estudo sobre a utilização de sistemas, programas e ferramentas da qualidade em empresas do interior de São Paulo. Prod., São Paulo, v.21, n.4, p.708-723, 2011.

PADOVANI, Marisa; CARVALHO, Marly Monteiro de; MUSCAT, Antonio Rafael Namur. Seleção e alocação de recursos em portfólio de projetos: estudo de caso no setor químico. Prod., São Carlos, v.17, n.1, p.157-180, 2010.

RABECHINI JR., Roque; CARVALHO, Marly Monteiro de; LAURINDO, Fernando José Barbin. Fatores críticos para implementação de gerenciamento por projetos: o caso de uma organização de pesquisa. Prod., São Paulo, v. 12, n. 2, p. 28-41, 2002.

RABECHINI JR., Roque; PESSOA, Marcelo Schneck de Paula. Um modelo estruturado de competências e maturidade em gerenciamento de projetos. Prod., São Paulo, v.15, n.1, p.34-43, Apr. 2005.

RABECHINI JR., Roque; PESSOA, Marcelo Schneck de Paula. Um modelo estruturado de competências e maturidade em gerenciamento de projetos. Prod., São Paulo, v.15, n.1, p.34-43, Apr. 2005.

SOHN Joachim Schauß Bernhard Hirsch Matthias. "Functional fixation and the balanced scorecard", Journal of Accounting & Organizational Change, Vol. 10 Iss 4 pp. 540 – 566, 2014.

TRIPP, David. Pesquisa-ação: uma introdução metodológica. Prod. São Paulo, v. 31, n. 3, p. 443-466, 2005.

TRIVELLATO, Arthur Antunes. Aplicação das Sete Ferramentas Básicas da Qualidade no Ciclo PDCA para melhoria contínua: estudo de caso numa empresa de autopeças. São Carlos, p. 11-71, Dec. 2010.