Prescriptive Cost Management for Lean Supply Chains:

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Extending Inter-Organizational Cost Management through Ratio Project Planning

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Abstract. Nowadays, companies belonging to global supply chains should rely on the co-operation from suppliers to achieve their business objectives and the required profit levels. Inter-organizational Cost Management (IOCM) means co-ordinated activities to control and reduce global supply chain costs, which are promoted by buyers, suppliers or both. Ratio Project Planning (RPP) is closely related to IOCM and to Kaizen Costing (KC) and it can be viewed as an extension and a complement of these practices which have a prescriptive nature being focused on "what should we do?" instead on "what has happened?" or "what could have happen?". This research project was developed in Bosch Car Multimedia located at Braga, Portugal, a world-class manufacturer of electronic products, car radios and car navigation systems. This enterprise has many years of experience on reduction costs, particularly, using RPP.

Keywords: Target costing kaizen costing · Inter-organizational cost management · Ratio planning project · Cutting-costs

1 Introduction

Nowadays, production and business strategies oriented only to the optimization of internal resources are inadequate, making it necessary to create links between internal processes, suppliers and customers in a (global) value chain perspective [1]. The pressure created by global competition forces companies to reduce costs from the design phase until the end of the product life cycle [2]. Thus, organizations have sought to improve their skills regarding a better management of supply chain overall costs or to understand the cost-to-serve in different contexts (e.g. business channels, specific clients). Simultaneously, there has been a concern and a real need to involve business partners earlier and more deeply in these processes.

The Japanese automotive industry has been improving and refining such cost management processes for several decades in the second half of the twentieth century [3]. Namely, through Target Costing (TC), Kaizen Costing (KC) and Inter-Organizational Cost Management (IOCM). On one hand, TC is applied in the development phase of a new product and Kaizen Costing (KC) in the production phase. On the other hand,

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IOCM is the extension of cost reduction systems and respective tools to the supply chain, i.e. involving suppliers [4].

Furthermore, in markets characterized by a high demand of quality, usability and functionality for their products along with the fierce competition, cost control and cost reduction practices need to evolve from the traditional descriptive approach, which uses business intelligence and data mining to ask: "What has happened?" or predictive, which uses statistical models and forecasts to ask: "What could happen?" to a more prescriptive logic, which uses optimization and simulation to ask: "What should we do?".

This research focused on cost reduction systems applied by companies in a lean supply chain context where companies are challenged to improve continuously the way they design, develop, produce and deliver their products and services. More specifically, it analyses and discusses a cost reduction approach developed and applied worldwide in Bosch plants. The research field is an important Bosch Car Multimedia plant located at Braga, Portugal, where car radios, electronic products and sophisticated car navigation systems are manufactured. This enterprise has many years of experience on reduction costs and particularly, using the Ratio Project Planning (RPP) methodology. Inter-Organizational Kaizen Costing activities are those that most closely match the RPP methodology. Often, an RPP involves suppliers and it is implemented only after the approval of the client because it must be a joint decision of Bosch and its clients. Therefore, the RPP is a cost management methodology that goes through the entire supply chain.

Through the analysis of this case, this work aimed to study and discuss the feasibility an importance of RPP in the context of IOCM and KC practices which contribute decisively to sustainable lean supply chains. The context, the reasons and the implications of the various aspects that separate and approximate theory and practice on supply chain cost management can be highlighted through this case. A particular importance to RPP benefits and limitations as well as challenges is given in this paper.

2 Inter-Organizational Cost Management (IOCM)

In global supply chain, companies need to involve business partners to explore properly cost reduction opportunities [5]. The increasing complexity of products, the reduction of the life cycle of products, the increasing complexity of the business and production processes, the greater (need for) interconnection between buyers and suppliers, make the success of each company be strongly dependent on efficient relationship with suppliers [5]. That is, it is necessary to have implemented successfully, in some degree, any kind of Inter-Organizational Cost Management Practices (IOCM). Furthermore, for these practices be effective and sustainable, each company must act in order to also benefit the other companies involved (i.e., clients and suppliers) namely, sharing the benefits achieved through cost reduction initiatives, i.e. building true win-win strategies [4].

IOCM should be included into the broader concept of Total Cost Management (TCM) which is characterized by the application of cost management practices to all

stages of a product's life cycle, asking for the collaboration of all company employees and departments as well as business partners in the upstream (i.e. suppliers) and downstream (i.e. customers) supply chain. The TCM includes Target Costing (TC), Kaizen Costing (KC) and Inter-Organizational Cost Management (IOCM) [6, 7].

Target Costing (TC) is applied to the development phase of a new product and is focused on not exceed the maximum allowable cost which is computed considering the product's target price that the market accepts and the margin that the company intends to achieve for that product which should be aligned with the long term strategic planning of the company [8, 9]. Furthermore, Kaizen Costing (KC) is applied later in the production phase, being an extension to the production of the cost management activities performed using TC in the development phase. The Japanese term "kaizen" refers to cumulative improvements that result from repetitive activities rather than by improving by innovation. Improvements based on technological innovations are usually made in the development phase of a product's life cycle. Nevertheless, being applied to the production process, KC can result in cost reductions that affect multiple products over several years. The impact of KC will be leveraged if all supply chain elements participate in such projects of cost reduction. In fact, due to the outsourcing of many activities and processes through the supply chain (i.e. to the upstream or suppliers), the knowledge on the process and the materials is, nowadays, increasingly concentrated in the suppliers.

The Value Engineering (VE) and Value Analysis (VA) tools are characteristics of TC and KC, respectively. They are used to find ways to reduce the cost of the product in order to not exceed the target cost previously defined accordingly to the conditions of the market (i.e. target price) and of the business plan (i.e. target margin). This process involves the supplier to confirm the cost of purchased components and the production and assembling costs of the buyer [2]. Companies use several tools to attain the maximum allowable cost or target cost [9-11]. For example, Design for Manufacturing and Assembly (DFMA) that is focused on reducing costs by turn products easier to manufacture or assemble, maintaining its quality and functionality - i.e., lowering costs during the production and assembling stages in the buyer's plant. On the other hand, quality function deployment (QFD) proportionate a structured approach aimed at ensuring that the development process does not compromise customer requirements.

Inter-Organizational Cost Management (IOCM) is the extension of the cost reduction activities and respective tools to the supply chain [4]. The IOCM is described as a structured approach to coordinate cost management activities which can be generated or lead by buyers or suppliers or even jointly [4]. To put IOCM fully in practice, all companies in the network have to adopt lean buyer-supplier relationships dedicated to produce low-cost products with a high level of functionality and good quality that can meet the needs of the clients or the market. The use of IOCM to coordinate cost reduction projects in supply chains may be useful in three different ways. Firstly, it can contribute to reduce production costs. Secondly, it can help to find new and different ways to develop products at lower costs. And finally, it may be useful to identify ways to increase the efficiency of the customer-supplier interface.

3 Research Methodology and Case Study

The adopted research methodology was the case study. It is a research strategy whose results can be transferable to theory (not generalized to a population). In a case study, findings can be used to formulate theoretical propositions [12]. According to [12], the construction of a case study has to ensure a logical sequence and connection among the empirical data, the initial questions of the research work and the findings. In this work, several sources of data were used namely, company documentation, records of implemented RPP and direct observation of the methodology and its application.

The unit of study is the Purchasing department of a Bosch's plant located in Braga, Portugal. This plant has more than 2,000 employees and reached a turnover of 700 million USD. In 2017 it will have more than 3,000 employees and a turnover exceeding 1 billion USD. Among other products (for example, sophisticated car navigation systems) this plant produces printed circuit boards (PCB) which are applied in various products. One of the main objectives of the purchasing department is the definition of cost reduction activities. Indeed, the plant of Braga is very sensitive to the importance of reducing costs continuously. Its strategic challenges include: be cost competitive, have quality excellence, be efficient in all processes, optimize the plant, have excellent customer service and manage the supply chain efficiently.

4 Findings and Discussion

In this case study the application of the Ratio Project Planning (RPP) methodology was studied and analyzed. The findings were analyzed in the light of what is presented in the literature on IOCM and KC in order to connect theory and practice and also to extend both. The analysis of this case resulted in interesting findings considering that several similarities but also differences between the literature and the case were found.

4.1 Ratio Project Planning (RPP)

The Ratio Project Planning (RPP) is a cost reduction initiative or project aimed at making a product that is already in the production phase more profitable. Each RPP is reported in order to be achieved an aggregated view of all company's RPP. Such RPP tracking list is constantly updated and the results are entered in the quarterly business plan and contribute to the annual business plan of the company.

The RPP projects are usually justified by changes in product requirements/product design, changes in the product bill of materials, changes related to suppliers (e.g. inclusion of a new or a second supplier, change of locations), outsourcing, etc. Moreover, an RPP may also result from the application of ideas from other business units; results of market research; the introduction of a new supplier; changes in pricing strategies; updating suppliers for Request for Quotation (RFQ) and Comparison of Quotation (CoQ); existence of alternative manufacturing processes or improvement proposals/innovation; results or ideas produced in technical workshops; value analysis; benchmarking exercises; optimization of processes in the plant or in suppliers. The Total Cost of

Ownership (TCO) and Activity-Based Costing (ABC) are two important tools in RPP projects. The involvement of suppliers is of great importance. The RPP Process is presented in Figure 1.

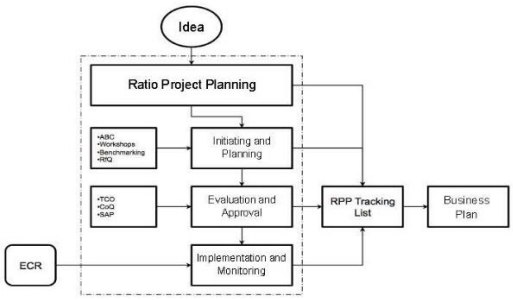

Fig. 1. The RPP process

Figure 1 illustrates all stages of the RPP methodology from its creation to the implementation, and considering the necessary inclusion of the results into the business plan of the company. Thus, an idea that may reduce costs can be promoted externally or internally and it goes through three generic stages: 1) launching and planning, in which cost reduction opportunities that can result in a RPP are identified; 2) evaluation and approval, in which the RPP coordinator defines implementation priorities taking into account several aspects namely, the cost ratio (benefit) estimated, planning effort, requirements for the implementation, implementation date, volume planned in the context of the business unit and responsibility of the project, among others; and 3) implementation and monitoring, in which the RPP are implemented and evaluated. All changes need to be approved using an engineering change request (ECR). Engineering changes are allowed only if there is evidence of an improvement in customer satisfaction or competitiveness and/or the quality of the product.

4.2 Findings

In recent years, the Braga's plant has been diversifying its business portfolio, which led to the emergence of the Electronic Manufacturing Services (EMS) business unit. This product diversification has brought new customers who had "build-to-print" projects, in which the client is completely responsible for the product development and the manufacturing company is only responsible for producing the product just like it was designed. This situation resulted in potential new suppliers to other products.

Thus a RPP project was developed to test the possibility of inclusion of one of those new suppliers. A set of conditions were defined to determine which products would be targeted for the RPP project namely the following two, PCB with high planned purchase value (in order to magnify the impact of the RPP) and PCB that have been provided solely by one supplier. Having identified the PCB that would be the targeted for the RPP project, a series of requests for quotation were started initially with 6 PCB and 3

suppliers. The offers received showed that a supplier, hereinafter designated NewSupplier was the most competitive, with prices about 20% lower than the other competitors. Therefore, it was decided that the RPP activities would be focused on NewSupplier. It is important to notice that, for internal clients, i.e. companies belonging to the Bosch Group, there is not a fixed price for a product thus, the internal client will benefit of having a product that can be bought at lower cost. On the other hand, in the case of external clients, Bosch receives all the gains made by RPP projects. However, it is important to communicate to the customer the advantages of the changes implemented in order to get its agreement and its active participation in the implementation of the RPP. Table 1 summarizes the savings associated to the implementation of this RPP.

Table 1. Savings in USD by PCB and client of the RPP.

PCB	Client	Previous Price	Price New Supplier	Potential Savings	Obtained Savings	Total Savings
0000001	Client 1	$4.262	$3.390	$0.872 (20%)	$0.062 (16%)	$174,320
0000003	Client 1	$4.189	$3.600	$0.588 (14%)	$0.749 (11%)	$61,230
0000004	Client 1	$4.058	$3.390	$0.537 (14%)	$0.118 (14%)	$448,656
0000006	Client 1	$3.577	$3.100	$0.477 (13%)	$0.019 (11%)	$42,140
0000007	Client 1	$3.294	$2.800	$0.494 (15%)	$0.043 (12%)	$31,616
0000009	Client 1	$2.025	$1.600	$0.401 (20%)	$0.401 (17%)	$87,995
0000012	Client 1	$2.219	$1.650	$0.569 (26%)	$0.569 (21%)	$66,459
0000013	Client 1	$4.210	$3.390	$0.798 (19%)	$0.798 (16%)	$32,995
0000021	Client 1	$1.475	$1.100	$0.375 (25%)	$0.375 (20%)	$33,044
0000005	Client 2	$0.487	$0.410	$0.077 (16%)	$0.062 (13%)	$61,600
0000010	Client 2	$3.893	$2.957	$0.936 (24%)	$0.749 (19%)	$74,880
0000014	Client 2	$0.606	$0.460	$0.140 (23%)	$0.118 (19%)	$51,920
0000015	Client 2	$0.194	$0.170	$0.024 (12%)	$0.019 (10%)	$25,728
0000027	Client 2	$0.404	$0.350	$0.054 (13%)	$0.043 (11%)	$12,163
0000037	Client 2	$0.214	$0.230	-$0.016 (-7%)	-$0.013 (-6%)	-$3,816
0000045	Client 2	$0.178	$0.182	-$0.004 (-2%)	-$0.003 (-2%)	-$605

This RPP allowed to find immediate opportunities to reduce costs which reached around 1.2 million USD as a result of the introduction of NewSupplier. Gains were achieved with two clients and different products (PCB) - Client 1: 978,456 USD and Client 2: 221,870 USD. In some products the savings exceeded 20% of the previous price but the final earnings were lower because the company chose to keep a second supplier which accounts for 20% of the total production volume. This potential loss can be considered as an investment to reduce supplying risk. On the other hand, in the case of Client 2, the company accepted higher prices in two products because the overall cost associated are significantly lower than in the past.

However, this RPP project and particularly the inclusion of this new supplier took a long time to be implemented. In the planning it was determined that this RPP would be completed in 25 weeks but it took 50 weeks. In other words, this project had a 25 weeks delay. This resulted in an opportunity cost and a loss of profitability for the company and for its customers. To estimate the value of the losses in this period of time, it was considered the estimated annual volume and the correspondent weekly production which was multiplied by the amount saved by PCB. The opportunity costs or cost savings that have been not achieved are presented in Table 2.

Table 2. Opportunity costs.

PCB	Annual Volume	Volume for 25 weeks	Unitary Savings (PCB)	Losses due to 25 Weeks of Delay
0000001	150,000	72,115	$0.697	$50,264
0000003	80,000	38,462	$0.471	$18,115
0000004	400,000	192,308	$0.561	$107,885
0000005	500,000	240,385	$0.062	$14,904
0000006	65,000	31,250	$0.381	$11,906
0000007	40,000	19,231	$0.395	$7,596
0000009	90,000	43,269	$0.345	$14,928
0000010	50,000	24,038	$2.930	$70,433
0000012	76,000	36,538	$0.455	$16,625
0000013	30,000	14,423	$0.660	$9,519
0000014	220,000	105,769	$0.118	$12,481
0000015	670,000	322,115	$0.019	$6,120
0000021	65,000	31,250	$0.300	$9,375
0000027	140,000	67,308	$0.043	$2,894
0000037	150,000	72,115	-$0.013	-$938
0000045	90,000	43,269	-$0.003	-$130

In this case the opportunity costs reached 351,978 USD what is a significant amount. Indeed, beyond savings obtained there are also hidden savings or opportunity costs which should also be taken into account. These lost opportunities appear frequently when many collaborators from different departments are involved in RPP projects. There is a lack of leadership in these projects what affects the good development and the effectiveness of the RPP. The inexistence of a department or specific collaborators to manage RPP projects is a relevant weakness of this methodology that deserves attention. The Bosch's plant located at Braga has a long experience with these cost reduction projects and those who are responsible for them indicated that delays are recurrent, typically when the RPP is launched internally.

5 Conclusions

Bosch has many years of experience on reduction costs and particularly, using Ratio Project Planning. Through this case study, this work aimed to study and discuss the relevance of RPP on the literature and practice. This methodology aims to achieve reduction costs in the production phase. Inter-Organizational Kaizen Costing activities are those that most closely match the RPP methodology. The case study presented here showed that the principles, concepts and cost reduction tools presented in the literature are already in some way internalized by the company and applied through the company's daily practices. However, there are important aspects that deserve to be highlighted.

Although some limitations, the methodology adopted by Bosch has been contributing to significant and substantial cost reductions. In the case presented here, the inclusion of a new supplier, they were obtained savings of more than 1.2 million USD. However, it was also clear that (recurrent) delays with the implementation of such kind of projects entail opportunity costs or lost savings; in this case, estimated in 350,000 USD. These delays are not only justified by internal operations. The fact that, generally,

these activities of cost reduction ask for the involvement of both clients and suppliers imply long waiting times between the necessary iterations.

As a follow up of this work there are some research opportunities that can be suggested. On one hand, they can be developed studies to understand better other RPP projects in the company. On the other hand, the conceptualization and application of the RPP methodology can be improved. It applicability to other companies and industries can be also tested and validated. Furthermore, the comparison with other approaches and methodologies for cost reduction in supply chains is still requiring study and discussion. Particularly, KC literature needs contributions for both theory and practice. Finally, the collaboration and interaction between buyers and suppliers in supply chain cost management during the production stage also needs to be better conceptualized. In this case, the RPP methodology can be used to complement or extend IOCM-KC as it is discussed in this paper.

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References

1. Christopher, M.; Gattornab, J.: Supply Chain Cost Management And Value-Based Pricing, Industrial Marketing Management. 34, 115–121 (2005)
2. Bragg, S. M.: Cost Reduction Analysis: Tools and Strategies. Wiley (2010).
3. Monden, Y.: Cost Reduction Systems: Target Costing and Kaizen Costing. Productivity Press (1995)
4. Cooper, R. A., Slagmulder, R. A.: Supply Chain Development for the Lean Enterprise: Interorganizational Cost Management. Productivity Press (1999)
5. Micheli, G. J. L., Cagno, E., Di Giulio, A.: Reducing The Total Cost Of Supply Through Risk-Efficiency-Based Supplier Selection In The EPC Industry. Journal of Purchasing and Supply Management. 15(3), 166-177 (2009)
6. Cooper, R. A., Slagmulder, R.: Target Costing and Value Engineering. Productivity Press Inc. (1997)
7. Carr, C., Ng, J.: Total Cost Control: Nissan and Its U.K. Supplier Partnerships. Management Accounting Research, 6(4), 347-365 (1995)
8. Kato, Y.: Target Costing Support Systems: Lessons From Leading Japanese Companies. Management Accounting Research, 4(1), 33-47 (1993)
9. Iii, A. L., Smith, W. I.: Target Costing For Supply Chain Management: Criteria And Selection. Industrial Management & Data Systems. 100(5), 210-218 (2000)
10. Weil, R. L., Maher, M. W.: Handbook of Cost Management. Wiley (2005)
11. Yoshikawa, T., Innes, J., Mitchell, F.: Applying Functional Cost Analysis in a Manufacturing Environment. International Journal of Production Economics. 36, 1, 53-64 (1994)
12. Yin, R. K.: Case Study Research: Design and Methods. SAGE Publications (2003)