

# Competing globally with cost accounting: a case study

Maria Isabel Pedro <sup>#1</sup>, João Cancio Martins <sup>\*2</sup>, José António Filipe <sup>\*3</sup>

<sup>#</sup> CEG-IST Instituto Superior Técnico, Universidade de Lisboa, Portugal

<sup>1</sup> [ipedro@tecnico.ulisboa.pt](mailto:ipedro@tecnico.ulisboa.pt)

<sup>#</sup> Instituto Superior Técnico, Universidade de Lisboa, Portugal

<sup>2</sup> [ioaacanciomartins@gmail.com](mailto:ioaacanciomartins@gmail.com)

<sup>\*</sup> Lisbon University Institute ISCTE-IUL, BRU-IUL, ISTAR-IUL  
Portugal

<sup>3</sup> [jose.filipe@iscte-iul.pt](mailto:jose.filipe@iscte-iul.pt)

**Abstract** - In recent years, information has played a key role in business competitiveness, allowing not only to inform managers about external contexts, but also to internal problems. Thus, cost accounting has relevant tools, with the ability to provide information about how the resources of a company are used, making it possible to evaluate and improve their performance. The main goal of this research is to develop a different costing system model to a company, in order to provide distinct information on the costs of production processes, to help managers make better operational and strategic decisions. This company business is processing and packaging fruit and vegetables, in particular they are organized by three main sectors: fruit, potatoes and 4th range products. Those cost allocation methodologies could be identified, on one hand, the profitability of each product, helping to define the best medium-term strategy and, on the other hand, some operational faults. Basically, this work aims to prove the importance of costing models to improve the performance and the competitiveness in a real context.

**Keywords** - Cost accounting, Traditional costing systems, Activity-based costing, Time-driven activity-based costing.

## 1. Introduction

Information has played a key role in the development and evolution of the companies, making them more competitive. Those improvements are the result of the application of new operations and financial strategies, allowing a better perception of internal problems and external threats. The main goal of this paper is to introduce the importance of costing systems to recall information, to empower managers to take better decisions for their companies. This work begins with

a detailed study of the main methods and cost systems, in particular the traditional costing systems, activity based costing and time-driven activity-based costing. Afterwards, based on the analysis and the advantages and disadvantages of the methods and systems costs, it is adopted the methodology in order to apply to a real case study. Then, it is presented the case study, the description of the company's production processes, the resources used and the explanation of how costs were allocated. Furthermore, the model result is presented and is made the interpretation of model outputs. Finally, there are presented possible improvements related to strategic and operations aspects, as well as the main limitations and difficulties during the development of the model.

## 2. Literature Review

The literature review of this article concerns three main topics that follow a chronological order. The first refers to traditional costing systems, in particular to absorption, rational and variable methodologies, that are used since the beginning of the twenty century. The second method addressed, it is the Activity- based costing, which was developed during the mid-eighties by Cooper and Kaplan and it is known as an alternative to the methods referred behind. The last is Time-driven activity-based costing system, that it is an improvement of the ABC.

### 2.1 Traditional costing systems

Traditional costing systems are originated in USA and they were built for the first time in a textile

manufacture company (Johnson, 1981; Hutchinson, 2007), because, at that point, some managers started to develop tools to control inventories and production costs, to gain competitive advantages regarding their opponents. In fact, the design of those methods made it possible to determine the cost of a product, using only two parameters: variable costs and fixed costs. On one hand, variable costs are defined as proportional to the quantities that are produced, such as raw material and direct labour. On the other hand, fixed costs do not depend on the quantities, because they are always present, an example can be the rent of an installation (Cooper & Kaplan, 1992; Wickramashinghe & Alawattage, 2007; Karuppachamy, 2005). Then a question arises: Which types of costs should be quantified as a cost of a product? The absorption costing system defends that all the costs in a company should be quantified as cost of the product, because all the resources work together to guaranty that the product is produced, independently if are fixed or variable costs (Gupta & Parmar, 2001).

The variable costing system is a philosophy totally opposite to that mentioned above, as it advocates that just the variable cost should be counted for the cost of the product (Gupta & Parmar, 2001). This perspective contributes with significant information to managers, in particular to short term decision (Nawaz, 2013). In fact, this methodology exposes the direct relationship between the quantities produced and the costs, allowing the observation of changes in inventories (Drury & Tayles, 1997). Finally, the rational costing system requires an analysis of the costs that actually contribute directly for the production and only they are inputted in the model as costs of products. Usually are considered all variable costs and it is attributed a percentage for the fixed costs (Franco et al., 2005).

The traditional costing systems were built and developed in time when companies produced little diversity products, with simple procedures and they gain competitive advantage by the quantities. In this context, traditional costing systems help managers set production strategies (Hutchinson, 2007), such define which products in order to increase profit (Zimmerman, 2003). However, with the introduction of technology and more diversity products, they meant that the production processes become to be more complex and flexible, making traditional

costing systems simpler and less effective (Johnson & Kaplan, 1987).

## 2.2 Activity-based costing

Given the limitation of traditional costing systems, in the mid-eighties Cooper and Kaplan developed the activity-based costing as an alternative. The ABC method aims to determine the cost of products or services, based on the allocation of direct and indirect costs. On one hand, direct costs are easily allocated, since it is unique costs of a particular object costing. On the other hand, indirect costs belong to various objects of costing, making the way it should be allocated. Basically, ABC lets you allocate overhead costs accurately and rigorous (Kee & Schmidt, 2000; Hutchinson, 2007), offering relevant information to managers, such as the price to be applied to a product, the real profit of each product, the used production capacity and which resources are being consumed (Boyd & Cox, 2002).

In the ABC perspective, consumption of the resources should not be allocated to product, but to the activities that give rise to products (Franco, et al., 2005). So, there are two main steps to build ABC system. The first is analyse all the procedures of process and identify each relevant activity. Then, it is needed to find resources and activities cost drivers, which by definition means, the measuring unit to transform the resource and the activity in costs (Franco, et al., 2005; Ferreira, et al., 2014).

The ABC, it is considered an excellent method of cost accounting, for its ability to properly allocate overhead costs (Major & Vieira, 2009; Barros & Ferreira, 2014), providing information to analyse external factors to the organization (Dalci, et al., 2010) and to identify internal flaws (Cooper & Kaplan, 1992). So, in this point, it provides a rigorous costs control and a deep understanding of costs causes (Innes & Mitchell, 2000).

Nonetheless, it presents some disadvantages such as high investment, it is demanding to implement and involves many people (Stratton, et al., 2009; Barros & Ferreira, 2014). Furthermore, there are some problems with data collection (Kaplan & Anderson, 2004; Demeere, et al., 2009), as, in a lot of cases employees distort, inadvertently, their performance in the interviews, contributing for less precise models (Oker & Adiguzel, 2010; Kaplan & Anderson, 2007a; Kaplan & Anderson, 2007b).

### 2.3 Time-driven activity-based costing

Time-driven activity-based costing is also a methodology to account and allocate correctly the indirect costs of organizations (Barros & Ferreira, 2014) and it was developed in 2004 by Kaplan and Anderson. This method was designed to be more simple and applicable in business context because it is less needed the information asked to employers, reducing the error of the model.

The main differences comparing to activity-based costing are the ways that cost drivers are calculated. In ABC it is necessary to define a cost driver for each resource, which meant that each cost driver had a distinct unit. In the case of TDABC there is only one unit, time (Ferreira, et al., 2014; Kaplan & Anderson, 2004).

The process to apply this methodology starts by understanding production processes. Then, managers need to identify the activities and the resources consumed in each activity (Ferreira, et al., 2014). Later, it required to calculate two different parameters: the unit cost of supplying capacity and the time required to perform a transaction or an activity (Kaplan & Anderson, 2004). The first results in the division between the total cost of the resource in the activity provided by the capacity of the time (Reddy, et al., 2012), the second is calculated by time equation, which is an algebraic sum of the minimum time to carry out this activity and the estimated time multiplication ratio of incremental activity (Kaplan & Anderson, 2004).

After that, the multiplication of these two parameters results in the cost of the activity for each product.

TDABC has aimed to be a simple, easy to implement and to reduce maintenance costs (Tse & Gong, 2009; Reddy, et al., 2012). In other point of view, this methodology can be applied in complex cases, as the extent of the problem only causes a linear increase of time equations (Kaplan & Anderson, 2007a; Everaert, et al., 2008a; Barros & Ferreira, 2014).

However, because the TDABC is a recent methodology, there are few practical studies to prove some of its advantages presented above (Barros & Ferreira, 2014).

## 3. Methodology

After literature review, it is possible to conclude that the most flexible and simple methodology to implement is the time-driven activity-based costing. It is a versatile model, since it can be applied for services, industries and logistics. That is why it was decided to build a TDABC model and apply it to the context of this case study.

Thus, for implement this cost system successfully will start to the mapping and description of production processes. Then, it will be important to identify the activities of each process and the resources consumed by them. Afterwards, begins the more detailed data collection phase, in which performs the data collection for each resource cost, the processing times and the calculation of the two parameters mentioned before.

With all the conditions to develop the model, it is supposed one can determine the cost of each product and evaluate which of them are profitable. To complete the results study, it was decided to perform two separate analyses: the breakeven point for sales prices and the breakeven point for production quantities.

As conclusion, we will present some limitations of the study and improvement proposals both strategic and operational.

## 4. Case study

### 4.1 Introduction

This case study is about a company that transforms, prepare and package agricultural food products and sells to large food distributors, such as Pingo Doce, Jumbo and Continente. This organization has about 140 employees and 14 senior technicians working in three distinct areas: fruit, potato and 4<sup>th</sup> range salads and soups.

### 4.2 Process description

To be able to describe production processes it is essential to spend time in company's facilities, observing the flow of goods and people's movements. In this case study it was decided to present the processes for the three areas.

#### 4.2.1 *Fruit*

Products selected to look for this business are the Rocha pear and apples, in particular Starking, Golden, Fuji, Gala, Granny and other species.

The fruit process begins with the entry of food in the entry bay, which occurs in large quantities in the months of September and October, because it is the high season of pear and apples. After the arrival, the products are subjected to a quality control, defined for each order. If the quality criteria required are confirmed by a senior technician, the food is moved to the cold storage warehouses, where they are stored. When there is an order, the products are removed from the warehouses and are moved to the processing zone. In this area, the products are placed in a tank with water, to be washed, and after a while, they are automatically introduced in a conveyor belt to be calibrated and separated to the respective packaging lines. Finally, end, the end products are moved to the exit bay and transported to customers.

To build the model it is needed to identify the activities and the resources for each activity. So, after the description above, it is possible to determine that there are six distinct activities. The first is quality control which essentially needs a senior technician. Then there are three transport activities, termed "movement 1", "movement 2" and "movement 3". The first movement concerns the transport of raw materials for the cold storages. The second movement refers to the transport of raw materials for the transformation zone. The last one is the transport of the finished product to the exit bay. All of the movements involve the worker driving a forklift and the diesel consumption.

Finally, the processing activity is the processing of the products, which as mentioned above, carried out a wash product, its calibration and packaging. This process involves the consumption of water in the tanks, electricity to the electric motors of the line, the packaging material and the cost of the labour involved in processing.

#### 4.2.2 *Potato*

Potato transformation process is very simple compared to other products, due to partnerships with producers that deliver the products already selected by species and size. So, when products reach the facilities it is made a quality control to check if the company's requirements are met and then products

are placed in the transformation zone to be processed. After this processing the goods are sent to the exit bay.

The number of activities identified for the potato process are three. The first one is the quality control which involves a senior technician. The second is the processing activity that includes the water for the tanks, electricity to the production line, the packaging material and few workers. Lastly, the movement that transports final product to the exit bay.

#### 4.2.3 *4<sup>th</sup> range salads and soups*

As stated above, the products referred as 4th range products are ready-to-eat, in 5 particular salads and soup. The transformation process for those products are the most demanding and complex in the company, because raw materials are more perishable, quality control is very strict and there are a huge variety of products.

Just like the other processes, 4th range salad and soup process starts with a quality control activity to check the vegetables and it is done by senior technicians. When there is confirmation that the products meet the predefined requests they are transported to processing zone. The first phase of process is cutting that can be manual for salads, or automatic, for soups. Then, the previously cut products are introduced into the processing lines, where they are washed, centrifuged (just for salads), separated and packaged. Afterwards, the products are moved to exit bay to be distributed by clients.

The activities for this business sector are quality control, whose main resources are the senior technicians allocated to this area. Furthermore, there are two movements: "movement 1" and "movement 2" that refers to entry and exit the processing line and in those activities it must be accounted the diesel consumption and employees salary. As it concerns to the cutting activity it should be accounted the salaries of the employees and, in the case of soup, the consumption of electricity. Finally, in processing zone it should be quantified the costs of water, labour, electricity and packaging material.

## 5. Model

### 5.1 Resources

This section is intended to expose how information about the resources was obtained. The main resources used by the production processes are the raw materials, employees, senior technical employees, water, diesel, packaging material, electricity, transportation and rent. First of all, it was made a survey of the number of employees operating in each business area, both for workers and for the senior technicians. Then, together with company's managers, data was collected to be able to determine the cost drivers and unit drivers for the other resources. However, for packaging material, water and transportation, it was not possible to determine them, as the company did not have accurate information. So, it was decided, together with the company to estimate values according to the percentage of use of each resource in the respective business area. Thus, it were designed time equations and were made up questions to workers about the time spent in each activity.

## 5.2 Allocation

Taking into account some information gaps for some resources, they were made some adaptations to allocate costs to each product.

With regard to employees and senior technical works, it was done a direct allocation that is the account of the salary of each employee in their business sector. For the allocation of diesel and employees that work with the forklifts it was used time-driven activity-based costing, because it was simple to know the time of the activity "movements". In the cases of packaging material, water and transportation it was decided to use a percentage of utilization to allocate those costs, which means that the estimated value was multiplied by the total costs of the resource and distributed by each business area. Finally, rent was considered as a fixed cost, so that cost was allocated by square meters of utilization for each processing zone and for the warehousing in the case of fruit.

## 6. Results

To present the results it was decided to demonstrate the evolution of profit throughout the year, in order to realize the performance of each product. Consequently, it were made two distinct models to understand the sources of profitability and

impact of costs. Those models are named breakeven point for prices and breakeven point for quantities.

The breakeven point for sales presents the relations of the real price of sale and the price that guarantees the absence of losses. So comparing those relationships between the products it allows managers to understand the risk of profit so helping them to define better strategies. On The breakeven point for quantities helps them to realize the impact of variable and fixed costs in each product, identifying possible problems in production processes.

After the application of those tools, to analyze results, it was possible to observe different results for the three business areas. Fruit sector got losses throughout the year, essentially the pear. However, the main concern is the growth of losses due to increased electricity costs used in cold storage that contributes to even greater losses at the end of the year.

In the potato business area, the results were profitable in every month of the year given a reasonable contribution margin, due to the reduced purchase price secured from suppliers, and the high sales volume. Nevertheless, there are some risks, especially related to high competition that could adversely affect the results in other years. As regards to operational costs, it was noticed that they are lower in comparison with those of other business areas processes.

Finally, the 4th range salads and soups sector obtained extraordinary results, being the most profit business area. The reason for success was the high contribution margin that, in the case of salads, can reach 7 times the cost of purchase of raw materials. Furthermore, in spite of the high costs of transport and production, the selling and buying prices have reduced fluctuations, which means that the risk affixed in this sector decreases considerably.

## 7. Improvement proposals

This section aims to present possible measures to mitigate operational problems identified during the study. First, it was necessary to standardize the manual cutting processes used in salads production process because it could improve cutting times, reduce waste and increase flexibility. To reduce inventory warehouses costs there are two solutions. The first one aims to study ways to optimize the

storage space. The second one it concerns other ways of energy to supply the warehouse refrigerator, such as solar panels. Relatively to water consumption, it was observed that the water of the tanks was changed based on a visual assessment by workers allocated to each business area. This method does not privilege the quality of washing, neither the optimization of this resource. For that reason, it was suggested the introduction of an equipment to evaluate water status or develop a statistical study that provides the average possible number of washes. Finally, it is proposed an implementation of a more accurate planning methodology to increase organization, to improve resources utilization and to greater efficiency in cost control.

## 8. Limitations

In this particular case study, motivated by confidentiality reasons, the prices of sales and purchase were changed a little, increasing the error of the results.

Lastly, the model does not include the costs of reception and preparation of packaging material, the empty travels of the forklifts and the time of cleaning and maintenance of production lines. All those cost are not related directly with the production of value, but are indispensable.

## 9. Conclusions

With this work it can be concluded that it was built an innovative cost model in the context of the case study, which not only presents a different view comparing to traditional costing methods, but also helps managers to make strategic and operational decisions. Although the results are not very accurate, due to scarce resources and lack of information on some variables, the model identified operational failures and some risks of certain business sectors. In view of the allocation, it was found that the application of Time-Driven Activity-Based Costing is very demanding. The experience to conduct a study in a real context, was a challenging as people are not very receptive to others, as they feel evaluated when making the questionnaires. However the exchange of views with the responsible, the interaction with employees and the analysis in a real context was a rewarding and enriching experience for me.

## References

- [1] Barros, R. & Ferreira, A. 2014. Do Custeio Tradicional ao Time-Driven Activity-Based Costing: Revisão de literatura e sugestões de investigação futura. RIGC - Vol. XII.
- [2] Boyd, L. & Cox, J., 2002. Optimal decision-making using cost accounting information. *International Journal of Production Research*, Volume 40(8), pp. 1879-1898.
- [3] Cooper, R. & Kaplan, R., 1992. Activity-Based systems: Measuring the costs of resource usage. *Accounting Horizons*, Volume 6(3), pp. 1-13.
- [4] Dalci, I., Tanis, V. & Kosan, L., 2010. Customer profitability analysis with Time-driven Activity-Based Costins: A case study in a hotel. *International Journal of Contemporary Hospitality Management*, Volume 22 (5), pp. 609-637.
- [5] Demeere, N., Stouthuysen, K. & Roodhooft, F., 2009. Time Driven Activity-Based Costing in an outpatient clinic environment: Development, relevance and managerial impact. *Health policy*, Volume 92, pp. 296-304.
- [6] Drury, C. & Tayles, M., 1997. Evidence on the financial accounting mentality debate: A research note. *British Accounting Review*, Volume 29, pp. 263-276.
- [7] Everaert, P. et al., 2008a. Cost modeling in logistics using Time-Driven ABC: Experiences from a wholesaler. *International Journal of physical Distribution & Logistics Management*, Volume 28 (3), pp. 172-191.
- [8] Ferreira, D. et al., 2014. *Contabilidade de Gestão: Estratégia de custos e de resultados*. 1ª Edição ed. s.l.:Rei dos livros.
- [9] Franco, V. S. et al., 2005. *Contabilidade de Gestão - O apuramento dos custos e a informação de apoio à decisão*. Lisboa: Publisher Team.
- [10] Gupta, P. & Parmar, N., 2001. Costing a Hospital service Product: Marginal vs Absorption Costing. Volume 57(3), pp. 230-233.
- [11] Hutchinson, R., 2007. *The impact of Time-Based accounting on manufacturing performance*, Toledo: s.n.

- [12] Innes, J. & Mitchell, F., 2000. Activity-Based Costing: A review with case Studies. London: CIMA.
- [13] Johnson, H., 1981. Toward a new understanding of nineteenth-century cost accounting. *The Accounting Review*, Volume 3, pp. 510-518.
- [14] Johnson, H. T. & Kaplan, R. S., 1987. The Rise and Fall of Management Accounting. *Management Accounting*, Volume 68(7), pp. 22-30.
- [15] Kaplan, R. & Anderson, S., 2004. Time-Driven Activity-Based Costing. *Harvard Business Review*, Volume 82, pp. 131-138.
- [16] Kaplan, R. & Anderson, S., 2007a. The innovations of Time-Driven Activity-Based Costing. *Cost Management*, Volume 21 (2), pp. 5-15.
- [17] Kaplan, R. & Anderson, S., 2007b. Time-Driven Activity Based Costing - A simpler and powerful path to higher profits. Boston, MA: Harvard Business School Press.
- [18] Karuppuchamy, R., 2005. A comparative analysis of management accounting systems on lean implementation. Tennessee, s.n.
- [19] Kee, R. & Schmidt, C., 2000. Integrating Activity-Based Costing with the theory of constraints to enhance production-related decision making. *Accounting Horizons*, Volume 9 (4), pp. 48-61.
- [20] Major, M. & Vieira, R., 2009. Activity-Based Costing/Management. In: *Contabilidade e Controlo de Gestão: Teoria, Metodologia e Prática*. s.l.:M. Major e R.Vieira, pp. 243-278.
- [21] Nawaz, M., 2013. An insight into the two costing technique: Absortion Costing and Marginal Costing. *Broad Research in Accounting, Negotioation and Distribution*, Volume 4 (1), pp. 48-61.
- [22] Oker, F. & Adiguzel, H., 2010. Time-Driven Activity-Based Costing: An implementation in a manufacturing company. *The Journal of Corporate Accounting & Finance*, Volume 22 (1), pp. 75-92.
- [23] Reddy, K., Venter, H. & Oliver, M., 2012. Using Time-Driven Activity-Based Costing to manage digital forensic readiness in large organizations. *Information Systems Frontiers*, Volume 14, pp. 1061-1077.
- [24] Stratton, W., Desroches, D., Lawson, R. & Hatch, T., 2009. Activity-Based Costing: Is it still relevant? *Management Accounting Quarterly*, Volume 10 (3), pp. 31-40.
- [25] Tse, M. & Gong, M., 2009. Recognition of idle resources in Time-Driven Activity-Based Costing and resource consumption accounting models. *Journal of Applied Management Accounting Research*, Volume 7 (2), pp. 41-54.
- [26] Wickramashinghe, D. & Alawattage, C., 2007. *Management accounting change: Approaches and perspectives*. New York: Routledge.
- [27] Zimmerman, J., 2003. *Accounting for decision making and control*. 4th Edition ed. New York: McGraw-Hill Irwin.