Analyzing Cost and Profitability using Process Based ABC

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Abstract—Presently there is an ever more increased pressure over organizations to stay efficient and competitive. This is so, not only because of a more and more competitive and global market but also due to a crisis that affected most of the world’s economy. This makes cost awareness and reduction one of the major concerns today. But, although almost all organizations reckon this need for information and a need to increase their profitability, efficient costing methodologies are out of reach for most Small companies which represent more than 90% of the European economy. In this paper we present a method that we believe reduces the costs associated with this process through re-utilization and standardization, and will also help on providing valued information for Business Process Re-engineering. We also provide a prototype to support the method. This proposal was demonstrated in four different industries and evaluated through interviews with experts and potential users.

Keywords—TDABC; BPMN; Costing; Templates; Business Processes

I. INTRODUCTION

Cost reduction has always been a concern for organizations. This concern has been accentuated recently by a more competitive economy and by a crisis affecting most of the developed world. Globally managers from all areas facing this situation are making cost reduction one of their top priorities [1][2]. On top of this, managers have the problem of not knowing the exact cost and profitability of their products or services making it impossible to know where to focus their efforts. This information is crucial not only for decision taking but also for business process reengineering and redesign which aims to increase performance [3].

Although the need for solving this problem is reckoned, it is needed some mechanism for organizations to be able to allocate not only the direct costs like materials to the final product, but also all the overheads like IT, electricity, and others and this is where most costing methodologies fail [4]. This would not be an issue if the ratio between indirect and direct costs was low, but its tendency is to rise [5] and in some cases this ratio already represents 80% [6].

To address this issue a number of costing methodologies were developed, being the most notorious Activity-Based Costing (ABC) [7] that allocates overhead and structure costs to activities allowing to get a better picture of their distribution in customer-end products and services, and more recently Time-Driven Activity Based Costing (TDABC) [8] that tries to reduce some of the complexity of ABC and to make it easier to implement and maintain a model.

With the proposed methodologies it would seem at first sight that there is a clear solution for the identified problem. The catch is that these costing methodologies take time to implement, have high costs associated with them, and require specific expertise. These last two requirements are usually not found in Micro and Small enterprises which account for 98,7 percent of companies in Europe [9]. Also some authors argue that these companies are inserted in the most competitive segment of the economy [10]. So the problem becomes that companies know they need to reduce costs, or at least have a clear understanding of them, but they do not have the means to apply the existing solutions.

Based on this we can define our problem: The costs associated to cost analysis make it unaffordable for SMEs. This problem leads us to two sub-problems, the first is related with cost modelling not being a first-class citizen and the second concerned to the fact that that cost reduction is offered as a one-time project and never as a service.

In this paper we present a solution for this problem based on the fact that most organizations inside some field or industry (e.g. Pharmacies, Hospitals) share most of their processes which makes it possible to develop a method that produces cost models that are generic enough to be applied to all organizations in that particular field (Templates) making it possible to dilute the costs associated with the analysis, thus making the process more affordable. For this proposal we use contributions from BPMN...
[11] and TDABC [8]. This method is then supported by a cloud-based prototype that will allow to offer it as a service.

After setting the context for this paper we will now give a brief description of its structure. Our research was done using the Design Science Research Methodology (DSRM) [12] [13], which aims to be a commonly accepted framework for the production of Design Science Research in Information Systems. This report reflects the structure of this methodology. We started by identifying and describing in detail the problem in the introduction (Section I). Having the problem defined we will present the state of the art, as well as other related work (Section II), and then present the objective we intend to achieve (Section III) and how we propose to solve the problem (Section IV). Then we will discuss about how the Demonstration (Section V) and Evaluation (Section VI) were conducted showing some projects that apply our proposal. Then we will present the communication step of our research (Section VII). Finally we will draw our conclusions about the proposal (Section VIII).

II. RELATED WORK

In this section we analysed Business Processes related concepts and definitions in order to provide a context for our proposal. We also give in this section a brief overview of BPMN and TDABC. Although other methodologies were analysed we will only present those used with our proposal.

A. Business Processes

In this subsection we intend to give a brief overview of the definition of business processes, business process modelling (BPMd), Business process management (BPM), Business Process Standardization (BPS), Business Process Reengineering (BPR), how they are linked together and how this paper is inserted in this context.

Business processes can be defined as a set of one or more linked tasks that are executed in a particular order to realize some goal. Normally they have inputs/outputs and are normally executed within the context of an organizational structure. Business Process Management (BPM) aims to provide governance of the processes of an organization to improve agility and performance. It considers the full cycle since Design to Optimization. It includes methods and tools to support the design, enactment, management and control of BPs [14]. On the other hand Business Process Modelling is the definition of manual or automatic definitions of a BP. Basically it consists on representing the business process with some notation. Business Process Standardization on the other hand is the effort of capturing the common activities done by organizations or similar and achieving homogenization of these processes within a firm or even multiple firms [15]. Finally Business Process Reengineering or Redesign (BPR) can be defined as a radical redesign of processes in order to obtain improvements in performance (e.g. cost, quality or service) [16] [3]. Figure 1 gives an overview of how all this concepts relate and where this paper is inserted.

This proposal is mainly focused in the modelling and monitoring steps of the BPM lifecycle. It is focused on the modelling of processes with special attention to its costs so that it is possible, after execution, to monitor those same processes, and giving as output their costs. This is useful for the optimization of processes.

This proposal also takes advantage of Business Process Standardization, since its goal is to produce templates that capture common processes between organizations.

B. BPMN


Although there are a large number of business process modelling available, the fact of being the most widely used and being applicable to any kind of organization [17] makes BPMN a primary candidate for any research that requires modelling of business processes. On top of this, and in specific to our research, it is important that BPMN was developed with the intent of being possible to be interpreted automatically, which will be valuable when importing Business Process Diagrams (BPD) to an Accounting Information System (AIS).

BPMN is a graphical notation that aims at providing a notation that is easily understandable for all stakeholders (e.g. analysts, users, developers, audit teams) to represent the steps in a business process. To achieve this it has four categories of elements: flow objects, connecting objects, swim lanes and artefacts.

Flow objects are events, activities, or gateways, and are elements that state what is done, in what conditions, and what
triggers the events. Connecting Objects indicate the flow between activities, events and gateways. This flow can also define message flow or associations. Swim Lanes work as a graphical separation of roles or departments, allowing to clearly identifying in inter-departmental processes, to which department each activity belongs. Finally artefacts are used to provide additional information about process that do not affect the flow.

Although BPMN allows representing almost any process, it fails to model the cost of the Business Process Diagrams (BPD’s), because it wasn’t considered in the standard. To solve this problem we took advantage of text-annotations in BPMN, and the concept of time-equations on TDABC.

In the context of this problem, we believe that any modelling language that represents the processes of an organization could be used for the modelling phase of our proposed method. We decided to choose BPMN because it is widely used, contributing in this way for the understandability of the results (since it is understood by all stakeholders in the process including managers) of this same method, and also because it is machine interpretable.

C. Time-Driven Activity Based Costing

Time-Driven Activity Based Costing (TDABC) [8] is a costing methodology developed to calculate the profitability of products/services with emphasis on allocating overhead costs to products/services. It was created with the intent of addressing some of the issues found when using Activity Based Costing (ABC) [18], a methodology popular in the 1980s and 1990s in which costs are calculated based on the assignment of resources to activities identified through interviews or estimations on the amount of the resource to allocate. This requires high engagement from managers and also introduces some uncertainty. Although it proved itself effective for simple processes with none or small variation, it becomes complex and not at all accurate for more complex processes.

To address these issues TDABC was created with the objective of being simpler, more flexible, focusing on assigning overhead costs not using a traditional top-down approach but a more accurate one that starts from transactions (bottom-up), and most of all, easier and faster to implement and maintain. Also like its name suggests, TDABC is based on the cost of activities (inherited from ABC) unlike traditional methodologies that were normally linked to product cost, therefore it gives more flexibility and detailed information.

To address simplicity, TDABC only requires values of two parameters: 1) The unit cost of a resource (e.g. IT Department), that can be calculated from the total expenses related to that particular resource divided by its capacity (normally expressed in time) and; 2) The time needed to execute a particular task. With these two values it is possible to calculate the cost of a particular activity simply by multiplying the time taken by the unit cost.

Regarding flexibility, TDABC introduces time-equations to solve the problem of Activity Based Costing (ABC) of each activity reflecting only one factor/condition [8]. If in the latter there was the need to create a new independent activity for each small variation, in TDABC, linear equations are used to model the different times consumed by an activity in each of the conditions it can occur and therefore the different consumption of resources. Taking as an example the packaging of an order that takes longer if the contents are hazardous. In ABC there would be two activities: one for standard packaging and one for hazardous packaging. In TDABC it is possible to express this variation with the following equation:

\[
\text{Packaging} = (3 + 5 \times \psi) \times \text{Logistics Department} \quad (1)
\]

with \(\psi = 1\) if hazardous \(V\ \psi = 0\) otherwise

This equation represents that the time taken by the packaging activity is 3 minutes, or 8 in case it is hazardous. With this time it is possible to calculate the cost by multiplying it by the unit cost of the Logistics Department.

Finally, TDABC also has the advantage of being able to give information about its own accuracy as well as help identifying waste, by comparing the calculated capacity of a given resource vs. the actual used capacity in a given period. If the sum of all the times of a particular resource used in activities is below its capacity it normally indicates that there is waste or inefficiency. On the other hand if it is above, it may indicate over-usage. On both cases the delta between capacity and usage may also indicate errors in the model construction.

III. OBJECTIVES

This section corresponds to the Objectives Definition step of Design Science Research Methodology (DSRM).

The main objective of this proposal is to present some mechanism that enables organizations, in particular SME’s, to solve the problems identified in previous sections. This resolution is based mainly on creating some cost analysis based on modelling and calculation method that is affordable, understandable, easy to use and less dependent on external consultancy, allowing for smaller organizations to conduct a bigger part of the analysis process.

Apart from this main goal there are some other more specific objectives that must be set:

- The method should not be specific to any particular kind of organization
- This method should not require specialized expertise upon the moment of the application on a organization
- The results obtained using this method should be reusable when applied inside the same industry
- The process should be from the moment a company decides to analyze its costs, to the moment where results are obtained, more affordable than traditional or currently used methods
• The method should provide results that are easily understandable and that are expressed in a clearly defined notation.

• Models obtained from this method should be easily fed to an Accounting Information System (AIS) that supports TDABC models.

There are also some objectives more specific to the prototype:

• The prototype should be cloud-based

• The prototype should have some way to introduce models

• Integration with financial data should be possible in the prototype

These objectives allowed us not only to assess the usefulness of our proposal in the evaluation phase, but also set us a roadmap for its development.

IV. PROPOSAL

This section corresponds to the design and development step of Design Science Research Methodology (DSRM).

This proposal aims to solve the problems identified and achieve the objectives set in the previous sections. In order to do this our proposal is a method that creates a template for a particular industry and then allows its instantiation for a particular organization of that same field, and a prototype to support its creation and instantiation.

This method, represented in figure 2, is composed of two distinct phases. A first one called Modelling Phase, done only once, where the field or industry is analyzed and where a generic cost model is developed using a organization in that same field/industry. To develop this cost model a modelling language like BPMN, DEMO [19] or Achimate [20] to model the processes for which the costs will be analyzed. We decided to use BPMN for the reasons stated in the related work, but the method as the flexibility to support any other language. To represent and quantify the usage of resources by activities as well as express conditions that may alter this usage TDABC’s time-equations are used. These activities are re-usable and are later used to create business processes. Once again it is important to mention that at this point the indication of the resources is done through variables and not by their actual values due to the model being generic.

The next phase is the Application phase. At this point the resulting template from the previous phase is applied to a specific organization. This consists on its instantiation and adjustment to the specificities of the organization. This can consist on the addition/removal of activities, changing the coefficients in time-equations or adding some unrepresented condition. This adjustment is required since not all organizations are the same even if belonging to the same industry. After the adjustment is completed it is only needed to instantiate the model with the actual costs of the resources, feed the model with transaction data and calculate cost and profitability.

We will now present in detail the model, and each step of the execution of its phases.

The Modelling Phase consists in six steps:

A. Definition of the Cost Object Hierarchy - The result of this step is a tree that represents the multiple levels of aggregation of cost objects that are possible starting below at the point of the transaction and going as high as the organization. An example of this tree is presented below in figure 3. This is useful to represent at what levels the cost/profitability analysis will be done (e.g. client/product) and decide for each level of aggregation what data is needed, for example the product/client Id.

![Fig. 2 - Proposed Method Summary](image-url)
B. Identification of Resources – This step consists on identifying all the resources used in the organization, and creating an allocation tree that represents how they organize themselves into resource pools. This structure of resources is important to identify direct costs, and create ways to allocate overhead costs to functional departments, without losing any information. For this purpose costs (direct and overhead) are grouped into resource pools through allocation drivers (percentage, headcount, etc). These resource pools represent in some way the departments that will execute the activities. When calculating RPs unit cost, the cost will be the total of all resources assigned to it while capacity needs to be measured for the resource pool.

C. Definition of Activities – With the elicitation of resources done, the activities that are executed by an industry must be identified. For each identified activity, the usage of resources must be modelled. For this purpose we use the contribution of BPMN, extending it so that it uses TDABC’s time-equations, to associate the resources and their costs to activities. Each activity must be linked through the time-equation with only and one only resource pool.

D. Construction of Business Processes – Since the method’s goal is to maximize reutilization, the same activity can be used in several processes, so that there is no need to create for two different processes, two different activities, which in reality would be the same. With this approach the creation of a business process consists on selecting the activities that compose it, and specify the conditions when they occur and their order. With the process defined, costs of the process result of the sum of the time-equations of all activities. The result of this step is exemplified in figure 4. To explain the time-equations we can see that activity 3 consumes 10 units of resource 3 if condition x is verified and 15 units otherwise.

E. Allocate Processes to Products – The cost of products/services is the final goal of the calculation so in this step of the modelling phase, for each product, the processes that contribute for its creation (or contribute with costs in some other way) must be allocated to it. Once again the cost of a product will result from the sum of the costs of the processes that contribute to it.

F. Definition of segmentation groups - Finally to conclude the modelling phase some levels of common of variation can be expressed inside the template. This comes from the fact that inside some industry there is sometimes some segmentation that can be based on a number of variables. These can be geographical, regarding size or equipment. By taking advantage of this segmentation it is possible to create packages that close the gap between the generality of the template and the specificity of the organization and making the next phase faster.

The modelling phase has its output a generic template that can be later used as input for the application phase where it is instantiated for a specific organization. The Application phase consists of five steps:

A. Resource Cost Gathering – The cost hierarchy obtained from the previous section represents, the resources of the organization and how support costs are allocated. To apply the template to a specific organization, it is necessary to gather the total cost and practical capacity for each resource of that specific organization so that they can be later used in a template. These costs will then reflect on the activities, and therefore in processes, and products.

B. Segmentation variables choice - At this point it is necessary to choose the correct segment of the template by choosing the one which variations better reflect the reality of the organization based on the options considered in the template.

C. Application of template – With the specific resource costs gathered, applying the proposed template is trivial. Using the model of activities obtained using some modelling language and time-equations to apply the model, it is only needed to replace the variables in the time-equations that represent the costs, by the actual cost rate of the resources of the application. Beyond this point, regarding costs the method would work as any other TDABC would.

D. Adjustment of Template – Obviously not all organizations, even if they belong to the same industry, are exactly the same. Some resources may have different costs (situation
covered by step 1 of this phase), the set of activities may not be exactly the same, and the sequence of the processes may be different, among others. To adapt the template to minor differences from organization to organization, if needed, changes are done in this step: Adjustments to the resource pool hierarchy, activities and processes can be added, and the usage of resources in those activities/resources can be adjusted by changing the drivers in the time-equations, thus reflecting the actual situation.

E. Calculation of costs – In the final step of the method, the calculation of costs for products is done using the calculations defined by the TDABC methodology. To run the TDABC model, the method receives as input data from transactions that is needed for variables in time-equations defined in the modelling phase. These define the variations of the usage of resources in the activities/processes. With the cost usage for each transaction, it is now possible to calculate the cost of each transaction and product according to the defined allocation and of the organizations, since it is the sum of its transactions), as well as the usage of cost and time of each specific resource that also gives us the waste/efficiency of it.

Finally although not depicted as an independent step there is a component of control, that upon each application of the template can give feedback in order to improve the generic model. For example, if while instantiating a template a process is missing, a user should verify if it is in fact specific to its organization of it should be added to the template, thus making it more accurate.

From the obtained values with the method, a wide course of action can be taken like calculating profitability of products, analyzing the efficiency of resources and make what-if analysis. On top of this information decisions can be made like investment or divestment on a product, but that is outside the scope of this paper.

It is also our belief that this method not only takes advantage of the concept of business process standardization, since as organizations tend to standardize processes between them, this would make it easier for the template while being generic to have a higher accuracy, as it also can contribute for organizations, in particular small ones, to try and standardize their processes working in more similar ways, obviously not losing their particular competitive advantages.

Regarding the prototype we will describe it based on its main features. A more detailed description can be found on [21] These are:

- **Usage of templates** - This feature allows the user to model and instantiate the models (templates), using the prototype.
- **Edition of Business Processes** - The edition of Business Processes is, on most Accounting information systems
specially those that use TDABC models, the most difficult aspect. To address this we developed a friendly interface to create the activities and their time-equations (fig.5)

- **Data visualization** - This consists on presenting valuable cost information, in charts and graphs that makes it easy for managers to pinpoint problems that need to be addressed

- **What-if analysis** - The goal of this feature is to provide a method for managers to change the conditions of their models and evaluate the impact of those changes. This aims at reducing the risk associated to the decision making process.

- **Integration with financial data** - This is crucial to achieve the objective of making the method easy to use. This consists on providing mechanisms to automatically retrieve the necessary data.

V. **DEMONSTRATION**

This section aims at explaining how the Demonstration step of the Design Science Research Method (DSRM) was conducted in this field study.

In order to demonstrate our proposal we developed templates for four different industries. In this paper we present the first field study to illustrate how the method was followed.

We started by choosing a field that could take advantage of our method. We reached the conclusion that Pharmacies were a very good example since:

- Pharmacies normally are small companies and their budgets do not allow them to execute a complete costing project.

- It is a field where most of the processes are very well-defined which we were able to confirm

- They belong to the Health segment, which is an area where costs are constantly rising and have become a serious concern around the world [22]. Also there has been some research related with TDABC done in this segment. [23]

- Considering the Portuguese case, pharmacies are struggling and cost reduction is becoming a must. [24]

- Finally, since it is a heavily regulated industry and most of the processes are common between them, the template should need less adjustment upon the time of its application.

With the field chosen we approached a pharmacy, proposed to create a template of the attendance service, and then calculate the costs in a pre-determined period. We then validated this same template in a second pharmacy.

With an organization to create the template, we conducted a series of interviews to assess what is the hierarchy of cost objects (represented in figure 6), which resources are used and how they are allocated into resource pools (represented in figure 7), and which activities are executed and then combined them into a process (step 1 to 4 of the modelling phase) Figure 8 represents the attendance service process.

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Fig. 6- Pharmacy Cost Object Structure

Fig. 7 - Pharmacy Resource Pool Definition

Fig. 8- Pharmacy Resource Pool Definition
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Regarding activities it is important that they are as generic as possible, not only because we are developing a template but also to take advantage of the capability of TDABC to represent multiple conditions for the same activity, this way they can be reused in several processes.

The information in the text annotations are the time-equations that represent the cost of an activity in the context of the template not of an organization (since the unit cost of a resource still has to be replaced by the actual unit cost). For simplicity we will describe only a segment of the attendance process to explain the notation. The process starts by a technician...
receiving a request for a drug (that costs 2 units of personnel). In case it is available, the technician will fetch the drugs (that costs 1 unit of personnel, plus 1 minute for each medicine that doesn't need preparation, or plus 3 if they do need).

Finally since all products receive costs from this process the allocation is trivial (step 5 of the modelling phase). Step 6 was not executed at this point, since the only segmentation variable we obtained was the use of drug-dispenser robots, but the pharmacies we contacted did not have this feature so it was not possible to capture this cost.

The result of this method was a template for a Pharmacy attendance service that can be later applied to other similar organizations with only minor modifications to the time-equations or to the activities, and easily imported by software to calculate the costs.

Within the first pharmacy we gathered the unit cost of each resource (step 1 of the application phase) represented in table I, and allocate them into the defined Resource Pools (table II) through the defined drivers and applied the template (step 3 of the application phase). Since the template was made based on this pharmacy, the second and fourth steps that consist on adjustment and selection of segmentation were not necessary so we proceeded to step 5 and calculated the costs. It is also important to mention that the values on tables I and II are not real and are here just for illustration purposes. To calculate the pharmacy's costs we used this model on a prototype we developed [27] and fed it with transaction data of one month. Only as an example, we got an average cost of each attendance of 1,36€. This cost includes not only the direct costs of personnel but also all overhead costs.

We validated this template in a second pharmacy, only for evaluation of the models, to know the amount of changes that would be needed . This pharmacy has a bigger structure than the first one, with more employees and bigger facilities. Regarding location it is the same. The template was shown to the technical director that agreed that the resources were exactly the same, as well as the process except for one activity that was missing to deal with queue management tickets. The remaining activities were found to be the same with the same time-equation meaning that the template represented already most of the process.

VI. Evaluation

This section corresponds to the evaluation step of the DSRM. To evaluate both the proposed method as well as the results obtained from the demonstration we conducted interviews with experts and potential users. To assist us in the interviews done to evaluate the model obtained in the demonstration we decided to use 1) the Four Principles proposed by Österle [25] and 2) the principles defined in the Moody and Shanks Quality Framework (MSQF) [26] (These principles although defined for data models evaluate aspects that were considered as an adequate guideline for this research).

Regarding the method, the interviews were done with experts and potential users of the solution with about 40 minutes duration each. Questions on these interviewees were mainly focused on the applicability of our proposal, that it would be in fact more affordable. These experts were: 1) a member of the board of a major consulting company, 2) the director of the urgencies of a public hospital, 3) a professor specialized on costs, 4) the financial advisor of another public hospital, 5) the owner of a pharmacy and 6) a cost consultant. The received feedback was positive and showed that the goals of the proposal are achieved by the method. The main ideas from these interviews were that in fact this method can be a contribution for more affordable costing analysis, that in fact organizations inside the same field share many processes and also some recommendations were made, as the already included aspect of introducing segmentation variables to make the instantiation easier and more adjusted. This observation was already taken into account in our proposal.

Regarding the model obtained demonstration it was observed that only one activity was different between the two organizations, which meets our expectations. To evaluate the quality of the obtained model we use the principles mentioned earlier and discussed them with the technical directors of both pharmacies. The results of MSQF were:

- Completeness: According to the practitioners feedback the model obtained is complete since all activities were normally present in the template and those that were not could be adjusted in the application phase. An aspect that was not possible to fully verify in the second pharmacy was the correctness of the time-equations.
• **Integrity**: Is highly dependent on the interviews. There is no business rule or other constraint that prevents errors defining the activities or time-equations of the model since it relies on interviews and observations.

• **Flexibility**: The ability of reflecting changes is achieved by the use of time-equations and the inclusion of the adjustment step on the method.

• **Understandability**: Practitioners found the models obtained very easy to understand since their notation is close to traditional workflows but asked for a better explanation of the time-equations.

• **Correctness**: The correctness of the model depends on the constraints of the modelling language used in the modelling phase. In our case the BPMN diagrams done according to the specifications.

• **Simplicity**: According to the practitioners the method is simple to follow, and what we verified is that it is simple to apply the template and reflect changes.

• **Integration**: Since the models try to reflect the processes of the organizations, their integration with the other models is trivial.

• **Implementability**: Implementability is solely dependent on the information available, and all the information needed by the model is by law registered (costs, invoices, etc.) or easily observable (time of activities).

The four principles of Österle are also met. These are:

• **Originality**: Research was made on the current literature, but a solution of this kind wasn’t found, nor did the practitioners knew of any.

• **Abstraction** – Abstraction of this method is met at two levels: (1) it should be able to be applied to any industry, (2) in the end of the modelling phase the result is a template for all organizations in an industry and not only a specific one.

• **Justification**: The artefact is supported by the related work, representations, and described by textual and graphical justified using the completeness, integrity and correctness criteria of the Moody & Shanks framework.

• **Benefit**: According to the practitioners’ interview, at least in the pharmacies industry, there would be valuable benefit, since at this time only rudimentary costing methodologies are available.

Regarding the objectives we defined, we believe that they were all achieved as did our interviewees, since 1) the method is not specific to an kind of organization (we applied it to two distinct pharmacies and we are now developing one for some hospital urgency processes), 2) our interviewees particularly potential users (that had no expertise in accounting) said they could understand and use the models; 3) the models were fed to a prototype; 4) Experts stated that in fact this method would be faster to implement as well as more affordable. But even with this feedback we are aware that several more case-studies will be needed to confirm this fact.

**VII. COMMUNICATION**

This corresponds to the last step of the DSRM and consists on communicating the results of the research to the proper audiences. For this purpose we made several demonstrations of our method with experts and potential users and submitted several papers. From these we highlight the following:

• Fernandes, J. , Vieira, C. , Lourenço, A. et al.(2012) Using Serious Games to Teach Business Process Modelling and Simulation ,Conference on Modelling, Simulation & Visualization Methods (MSV 2012), Las Vegas, Nevada, USA (Accepted)


**VIII. CONCLUSION**

Currently companies are inserted in a very competitive global market. This is even truer if we look to SMEs. This fact makes it unavoidable that cost analysis and reduction are a present point in every company’s’ agenda since the only way for them to keep competitive is by increasing their performance and become more efficient and, in particular, more cost-efficient since this is one of the main competitive factors [27]. But as it was shown, many of these organizations although they reckon the need for this effort they lack the capital both in terms of money and expertise to conduct a full analysis based on modern costing methodologies. This becomes close to a paradox. To improve companies need to reduce costs, but to reduce costs they have to spend money they do not have.

We believe that this proposal will make the costing process more affordable, both in capital as in expertise required. By using generic templates modelled in BPMN, a commonly accepted and understood notation, it will allow managers to have the ability to simply chose the template that better reflects their organization and apply it. On the other hand TDABC gives these models the ability to reflect costs as well as all the specificities of organizations that might affect those same costs.

The models obtained from this method can then be used in Accounting Information Systems as shown by the prototype developed. This prototype also brought some innovation, for example in what concerns support for templates, edition of business processes, financial data integration and visualization of data.
Regarding next steps, we believe they are to obtain feedback create templates for more industries so that it is possible to better evaluate the applicability of our method and continue the development of the prototype and make it publicly available so that it can be tested by users. We also think it would be an interesting aspect to consider doing some research around the option of providing costing information in real-time.

So in sum we believe that our proposal will, once it is fully developed and tested, make SMEs able to obtain more detailed information about their cost structures, helping them make better decisions and therefore become more competitive. We also believe that they will be able to this in a more affordable way that the ones available now. Although we are aware that its development still has to be continued, the feedback obtained from the proposal is positive and there has been a growing interest in our proposal.

REFERENCES


