Costing as a Service

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July 2014

Abstract

Cost awareness and cost efficiency has always been major concerns to organizations from all industries but in the last few years its importance grew due to the global economic and financial crisis. Considering their small size and market exposure, Small and Medium Enterprises (SMEs) need cost awareness and efficiency more than ever. However, efficient and accurate costing methodologies are out of reach for most SMEs. In this research we propose that costing should be offered as a service to reduce the cost of cost analysis.

Our research proposal is a cloud-based costing system that offers costing as a service using Time-Driven Activity Based Costing (TDABC) methodology and the concept of Business Process Costing Templates that together reduce the cost of cost analysis, especially for SMEs. We used the Design Science Research Methodology (DSRM) to conduct our research. This proposal was demonstrated in three Portuguese organizations and evaluated with feedback gathered from interviews and results from the system instantiation in all organizations.

Keywords: Costing, TDABC, Cost Templates, Cloud Computing, Cloud Services, SaaS

1. Introduction

Enterprises are becoming increasingly complex and managing that complexity is a growing challenge. Competition is fierce among these entities that always tried to differentiate between themselves through a variety of factors, one of which is efficiency. Cost efficiency has always been a major concern to organizations but in the last few years its importance grew due to global economic and financial crisis. Due to their small size and market exposure, Small and Medium Enterprises (SMEs) need cost efficiency more than ever [1].

However, as organizational complexity grows, so does the complexity of cost analysis [2]. Information about how and where the money was spent is a concern of organizations across all industries. Knowledge about costs distribution and true understanding of overhead costs allocation is essential for an enterprise to focus on the most profitable products and services [3].

In order to obtain detailed information about costs and overheads distribution several cost methodologies were developed. These methodologies evolved and differentiated themselves from traditional cost accounting systems to better distribute overhead costs that have been rising inside organizations in recent years [4]. The increasing importance of overhead costs comes from the fact that the industry has evolved from manufacturing to services [5]. This development implied a substantial growth of overhead costs being currently accountable for the major share of total costs [4, 5].

Organizations using these accurate costing methodologies know exactly where resources are being spent and what is the profitability of their products and services. However, although these costing methodologies deliver clear advantages to organizations, the adoption is far behind of what would be expected. One of the reasons behind this lack of adoption is the high costs of these methodologies for SMEs since they require time, expertise (internal know-how or consultancy services) and expensive and very complex software solutions that are out of reach for the most of these organizations [6].

2. Problem

Costing has been a major concern to all organizations since their genesis. As a competitive advantage, cost efficiency has been something that all organizations tried to achieve in order to increase their profit margins or reduce the price of their products or services. Cost efficiency is recognized as one of the most important aspects in respect to the competitive advantages of an organization.

Normally, organizations resort to cost accounting in order to analyse costs and achieve the de-
sired cost reductions. This approach as a major issue: traditional cost accounting systems give low detailed information and lack of the needed granularity to properly do cost analysis and, therefore, cost reduction. Not least, most accounting systems are focused on mandatory state-demanded reports [7] showing only large blocks of information totally misaligned with the organization’s business processes. Therefore, when it comes to calculate the cost of a product or service, traditional methodologies give inaccurate values, mostly because they lack the needed granularity and differentiation of information. Very often, such information is inaccurate because of wrong distribution of overhead costs that normally lead to bad decisions [8]. Correct distribution of overhead costs is truly essential since they have grown from being a minor share of the total costs to the major one [5].

Presently, there are several costing methodologies to address the abovementioned problem. These methodologies resort to the activities that occur inside the organization to design the flow of costs from the inputs (e.g. material) to the outputs of an organization (products and services). Knowing the flow of costs allow organizations to know exactly where money is being spent and what is the cost of a singular product or service. This cost awareness allows organizations to take measures to improve their efficiency.

The problem with these accurate costing methodologies is that they require a lot of expertise and are normally supported by very expensive and complex software solutions [6]. Whereas large organizations can support the costs associated with the required expertise and software solutions, SMEs cannot [6]. It is crucial that SMEs have access to these accurate cost methodologies since they operate in a market that is more competitive [9] and they are more exposed to the effects of an economic crisis [1].

We summarize the main problem of our research as:

Problem: *The costs associated to cost analysis make it unaffordable for SMEs.*

To solve this problem we propose that costing and cost analysis should be offered as a service instead of as an investment in a one-time project. This approach should enable organizations to access accurate costing methodologies because costs are diluted over time and the tools needed to perform this cost analysis are also offered as a service. Our proposal will also give organizations the ability to do on-demand cost analysis so that they can constantly evaluate the flow of costs as well as take measures to improve their cost efficiency.

3. Related Work

Here we will provide an overview of the tools and methods available that could contribute to solve the identified problem. The most relevant concepts necessary to understand the proposal will be emphasized throughout this section.

3.1. Cost Accounting

Cost Accounting (or costing) can be defined as the process of collecting, classifying, assigning and analysing the costs associated with the activity of an organization [10].

According to Vanderbeck [11], Cost Accounting provides the detailed cost information that management needs to control current operations and plan for the future. The goal of cost accounting is to gather all possible information so that it can be structured and used by management to take decisions and measure the organization’s performance.

Information Systems built to support Cost Accounting are called Cost Accounting Information Systems. Main goals of these systems include recording transaction data and calculating the cost of the outputs of an organization [11].

3.2. Costing Methodologies

Activity Based Costing

In the early 80’s a new costing methodology was created with the intention of bringing forward a new approach to cost information [12] that was not limited to tax and financial accounting which was the mainstream at the time [7]. Activity-Based Costing aims to solve the problem related to the ability to trace overheads costs (e.g. IT, Administrative, Marketing) to activities done within the organization that must reflect their cost on the organization’s outputs (products and services).

In order to implement the ABC methodology an organization should start by collecting information about all the functional and support costs, such as those abovementioned. Next, the trace between those costs and the activities that raised the need of those resources must be built. Afterwards, these activities should be routed to the organizational outputs that made those same activities necessary.

ABC methodology defines an activity as an action executed inside an organization (e.g. packaging or delivering a product) that have a particular cost rate based on the cost of the resources allocated to that activity. Allocation of resources to activities and then to the products or services of an organization is done based on interviews to those involved in the activities as well as in some estimates provided by the management team. This process results on splitting the costs related to the resources used by the activities, using variables like percentage, head-
count or any other unit that is found relevant to the cost analysis. Finally, output costs are calculated by summing the costs of all the activities that were needed to create the final product or service [10].

Traditional costing methodologies assign overhead costs by volume, that is overhead costs or support activities are distributed by products using some variable (or driver) that reflects capacity usage (e.g. number of hours) regardless of the specificities of the product. On the other hand, ABC uses activities which mean that different products may use a set of different activities and therefore a set of different cost rates to calculate the final cost of a product or service.

Although ABC has some advantages over traditional costing systems it also has some pitfalls. First, costs are calculated using individual subjective estimates from the management team and data provided from interviews with workers. The accuracy of these estimates may be questionable since, in most cases, there is no evidence of the correctness of the data. Wrong estimates may lead to errors and distort measurements [13]. Second, ABC requires not only the creation of an activity for every task performed inside the organization but also its cost specification. Thus, the complexity of the model grows with the number of activities. Finally, since it is common to have activities with variable costs (e.g. special packing vs standard packing) and ABC defines activities as single tasks with fixed cost rates, models tend to have many similar activities just to simulate variable costs.

Time-Driven Activity Based Costing

Time-Driven Activity Based Costing (TDABC) [13, 14] is an alternative costing methodology to ABC developed to calculate the profitability of products and services focusing on assigning overhead costs to these cost outputs. This methodology was created to address the ABC pitfalls described earlier.

The TDABC model simulates the actual processes used to perform work throughout an enterprise, therefore capturing far more variation and complexity than a conventional ABC model. Such variation and complexity is captured without significant demand for data estimates, storage, or processing capabilities. This model aims simplicity and flexibility while focusing on assigning overhead costs [13, 14].

Targeting simplicity, TDABC assigns resource costs directly to the cost objects requiring only two sets of estimates, neither of which difficult to obtain: the cost of supplying resource capacity for the department and the capacity usage by each transaction processed in the department [13].

The cost of supplying resource capacity (or capacity cost rate) is the total expenses related to a particular resource (e.g. IT Department) divided by its capacity (normally expressed in time). Total expenses of a department may include costs such as personnel, supervision, occupancy, equipment and technology. On the other hand, capacity is the time available from the employees to actually perform the tasks. Capacity used by each transaction is the estimated consumption of capacity (typically unit times) needed to execute a particular activity. After estimating these two values it is possible to calculate the cost of an activity simply by multiplying the estimated consumption by the unit cost of a resource.

Regarding flexibility and concerning the limitations of ABC of each activity reflecting only one factor/condition [15], TDABC introduces the concept of time-equations. As we described earlier, ABC required the creation of a new independent activity for each small variation needed to drive the cost. However, in TDABC, linear equations are used to model the different resources consumed by an activity. An activity may have different consumption of resources (such as time) depending on the conditions that occurred in a particular instance of that activity. If we take as an example the packaging of an order that takes longer when gift wrapping is requested, in ABC there would be two activities: one for standard packaging and another for gift wrapping. However, in TDABC it is possible to express this variation with the following equation:

\[
\text{Packaging} = (3 + 5 \cdot \varphi) \cdot \text{Logistics Dtp. CCR} \\
\varphi = 1 \text{ if gift wrapping } \lor \varphi = 0 \text{ otherwise}
\]

Finally, TDABC provides mechanisms to gather information about its own accuracy and to identify possible wastes or inefficiencies [13]. Given the capacity of a resource and the actual capacity used within a time period it is possible to calculate waste or inefficiency. If the sum of times used by a particular resource in the activities is below its total capacity it usually indicates that there is some sort of waste or inefficiency. On the other hand, if it is above, it normally indicates overuse. Indeed, discrepancies between capacity and its usage may also indicate errors in the model construction.

3.3. Business Process Cost Templates

Business Process Cost Templates is a method to reduce the costs of adopting efficient costing methodologies, such as TDABC, through re-utilization and standardization of business processes for organizations inside the same field or industry (e.g. Pharmacies, Hospitals). The main goal of these templates is to dilute the costs associated with the analysis
required to implement a costing methodology, in particular TDABC, making the adoption of such methodologies more affordable [16].

The method that creates a template for a particular field is composed of two distinct phases: a **Modelling Phase** and an **Application Phase**. The first is done only once and is where the field or industry is analysed and a generic cost model is developed using an organization within the same field or industry. The second, results of the application of the template produced in the previous step. The template is instantiated and the specificities of the organization are set. These specificities may include addition or removal of activities, changing the coefficients in time-equations, or adding some unrepresented condition. This adjustment is crucial since not all organizations are identical, even though they belong to the same industry or field [16].

4. Proposal

We can briefly describe our proposal as a cloud-based costing service that uses Time-Driven Activity Based Costing (TDABC) methodology and the concept of costing templates to reduce the costs associated with cost analysis.

In order to accomplish all the previously settled goals we developed a cloud-based costing service, i.e., a web-based system that supports an accurate costing methodology, TDABC, and the Business Process Cost Templates described in the Related Work section (section 3).

4.1. Costing Service Features

- Time-Driven Activity Based Costing methodology
- Business Process Costing Templates
- Creation/Edition of Business Processes and Time-Equations
- What-if Analysis
- Data Integration
- Data Visualization
- Automatic Pre-configuration

Offering a costing service in a cloud environment helped us achieve the needed technological cost reduction. Current solutions require local software installations that raise the costs of the service because, in addition to compel the purchase of the technological equipment needed, also involves operational costs such as maintenance and initial configuration. Those tools are also very complex and require expertise whenever modifications to the model are needed. This issue prevent managers from performing cost analysis as an ongoing process.

As for the costing methodology, we adopted TDABC for the reasons stated in the Related Work section (section 3). TDABC is an accurate costing methodology that solves the problems identified in previous methodologies, that is simple to understand and implement, providing quick benefits for those who adopt it [17]. TDABC also has clear connections with BPM that helped us connect it with Business Process Costing Templates.

Regarding Business Process Costing Templates, we chose to use them within our service because they provide a way of creating cost templates to some industry and distribute them for all the organizations that operate within that industry. These templates can be created and modified by an organization or by a cost analysis expert and be later included within our tool. Providing cost templates to more than one company leads to cost reduction regarding the needed expertise and consultancy services, since the cost of a template can be distributed by more than a single organization. These templates can be later improved and adapted to the reality of the organization deploying the template. Even though the organization may incur in a cost by doing this, it will be a lower cost when compared to the cost of a complete analysis.

Finally, What-if Analysis, Data Integration and Data Visualization, are meant to provide means of assessing the organization’s performance. Although these features are not directly related to cost reduction of the cost analysis, which is the main problem we want to solve, they are required to comply with the guidelines proposed by TDABC.

4.2. Costing Service - Analysis Process

We will describe the process that a user must follow in order to complete a TDABC analysis using our costing service.

Figure 1 shows the process of performing a cost analysis using the costing service. Users should start by configuring resources and resource pools and importing transactions. The order in which these activities are performed is irrelevant. If the costing service is being used by more than one user, each user may execute or be responsible for one of the activities. It is also important to note that by configuring we mean define and make the relevant associations. In the case of the resources, users should define, for every resource belonging to the organization, the name of the resource, its monthly capacity and the cost of providing such capacity. On the other hand, in the case of the resource pools, users should define the name of the resource pool and its classification, whether it is a support resource pool or a functional resource pool.
Afterwards, users should configure the resource pool structure, that is, which functional resource pools are charged with support resource pools.

Next, users must associate resources to the resource pools defined earlier. Resources can either be associated to support or functional resource pools. After completing these associations, resource pools will have their cost calculated in real-time so that the users can know the costs of their resources structure. This helps users validate the calculated values in order to prevent typing errors and other types of configuration issues.

The next step is the most important step of the analysis. Users should first decide if they want to automatically configure business processes and activities or if they want to manually specify them. The main difference is closely related to the quality of the data imported to the costing service. If users know that their data is valid and corresponds to the processes of the organization, they can let the tool automatically configure business processes and activities. On the other hand, if users already have some sort of “optimized” business process template, they should manually configure the tool. Users may also let the costing tool infer business processes and activities and then fine-tune them. We encourage users to perform an automatic configuration since this simplifies the process of analysis even further.

Finally, users should associate the functional resource pools to the business processes that those functional resource pools are accountable for and then order the software to compute the analysis. Running the analysis finishes the process of cost analysis. However, users may change resource cost values, fine-tune activities and business processes or change associations and then compute again the analysis.

5. Demonstration

We demonstrated our proposal by instantiating our artefact (the costing service) in three real-world organizations, namely “Social Security IT Institute”, “Defence Data Center” and “Card4B”.

The demonstrations consisted in instantiating the costing service to a particular organization, i.e., creating the cost template, within the costing tool, to the organization being tested. This includes the definition of resources, resource pools, business activities, business processes and the relationships between these entities to the particular environment of the organization being tested.

5.1. Social Security IT Institute

The Social Security IT Institute is a public institute, integrated in the indirect state administration, with administrative and financial autonomy and its own assets. It is an organization with nationwide intervention. Although several state competences have been assigned to the Social Security IT Institute, we focused our demonstration in the service desk competences of the institute.

Following the process described in section 4.2, we started by what we consider the most difficult task in the process of cost analysis: gather relevant data to feed the transactional data needed to perform the analysis. We asked the Institute to provide us with a CSV or spreadsheet file containing the data to be imported as transactional data. We had access to 8682 real transactions to perform the analysis.

Regarding the resources, there are several resources involved in all the business processes and departments inside the organization. These resources...
sources are diversified and include technical and management staff, electricity, rents, material and equipments. Although all these resources and resource pools (such as the Technical Support department) are properly identified, the organization opted to avoid gathering the unit costs of each resource and their contribution to the resource pools. This decision was justified since the organization had been previously involved in an cost analysis project. From the results of this project the organization knew the daily cost of the technical support staff from the technical support department. However, even though they knew this cost, they were unable to link it to the execution of the business processes, which is the main objective of our demonstration in the Social Security IT Institute.

Based on these limitations, we defined a resource and a resource pool that matched the daily value supplied. We knew that the monthly time capacity of this resource was 8 hours/day and 22 days/month, which was converted in minutes with a 10% waste on working hours, giving the final monthly time capacity of 9504 minutes for each technical support worker. If we assume (since we cannot disclose the real value) the cost of providing such capacity as 200€/day, the cost of providing 9504 minutes of technical support labour would cost 4400€. Since there is no other support resources or resource pools, this means that the CCR of this resource is 0.46€.

From the 8682 transactions supplied, the automatic configuration of the costing tool was able to detect 77 business processes with 791 unique business processes instances. This means that the calculations were performed using data from 791 complete executions of a business process (from the 77 identified). Figure 3 shows a sample of the results obtained from the analysis. The samples shows, for each business process identified, the average time and cost of execution as well as the number of instances that were identified for that business process. The red and green rectangles also show another interesting result from the cost analysis. The red rectangle shows a group of three business processes that were identified by the costing tool and that correspond to the same business process, as we were able to verify with the Social Security IT Institute management. This results from the wrong definition of workflows inside the IT Service Management software (EasyVista) which leads to wrong categorization of incidents/service requests in the service desk. The green rectangle shows the same problem described earlier but this time with an even minor difference (name pluralization).

Not only the costing tool delivered what was expected, i.e., the cost of executing the business process that accomplishes the resolution of a service request or incident, but also provided valuable insights to the organization regarding the workflows definition in the IT Service Management software. The organization can easily know the average time and cost of executing a business process. Moreover, the institute can further analyse the data and find the cost for every execution of every business process. The Social Security IT Institute management members considered these results very useful since they can now further analyse the different costs that the same business process generates. For instance, a desktop related incident as an average cost of 23,22€ but the minimum cost and the maximum cost of such incident was, respectively, 2,31€ and 70,83€. Having this information, the management may now try to understand what motivated such difference and take measures to mitigate the cause.

5.2. Defence Data Center

The Defence Data Center belongs to the General Secretariat of the Ministry of National Defence and among its several competences they are also responsible for service desk activities. The interest on demonstrating our proposal in the Defence Data Center arose when a member (IT Director) from the organization saw one of our presentations describing the costing service. The presentation that generated the interest was focused not only in the costing service but also its instantiation, i.e., the costing tool. This practical approach was very appreciated since we demonstrated that it is possible to deliver a quick and accurate cost analysis using our costing service, as we demonstrated with the case study of the Social Security IT Institute.

The Defence Data Center service desk uses EasyVista software for IT Service Management, i.e., the same software used by the Social Security IT Institute. It is also configured according to the best practices defined internally (ITIL). This means that the demonstration was almost identical to the pre-
vious case. Again, we followed the costing service process of analysis (section 4.2), starting with the integration of the transactional data. The feed of transactional data was again done through a CSV file exported from EasyVista, the IT Service Management software.

We had access to 34917 real transactions to perform the analysis. This represented over four times the number of real transactions available in the Social Security IT Institute. However, the costing tool is prepared to work with a high volume of transactional data, so the performance of the solution was not affected and all the features remained functional.

From the 34917 transactions supplied, the automatic configuration of the costing tool was able to detect 453 business processes with 5340 unique business processes instances. This means that the calculations were performed using data from 5340 complete executions of a business process (from the 453 identified).

Figure 4 shows a sample of the results obtained from the analysis. The sample shows, for each business process identified, the average time and cost of execution as well as the number of instances that were identified for that business process. Again, the red rectangle shows a group of three business processes that were identified by the costing tool and that correspond to the same business process. As we stated in the previous demonstration, this results from the wrong definition of workflows inside the IT Service Management software (EasyVista) which leads to wrong categorization of incidents/service requests in the service desk. Once more, we assumed resource and indirect costs that do not match the real values provided by the Defence Data Center.

![Figure 4: CaaSH - Defence Data Center - Business Processes Sample](image)

The costing tool delivered what was expected, i.e., the cost of executing the business process that accomplishes the resolution of an incident or service request. It also provided valuable insights to the organization regarding the workflows definition in the IT Service Management software.

5.3. Card4B

Card4B develops and operates integrated mobility solutions through interoperable contactless ticketing, passenger information, embedded systems and smartphones, systems integration and business intelligence. Presently, Card4B is developing a project, designated ecoDrive - Intelligent Eco Driving and Fleet Management, which is a multidisciplinary project, targeting the public transportation network, in which INOV is responsible for the identification of business processes (BPMN) and the cost analysis of those business processes using a TD-ABC approach.

The costing service described in the proposal (section 4) was adopted as a solution for the ecoDrive project since it delivered all the needed features to accomplish the objectives defined. However, this project required that the identification of business processes and activities was done prior to the system deployment, meaning that we would only have access to real transactional data after the system enters in production, since there is no digital data from the past.

Starting with the business processes, we were able to identify 10 different business processes, each of them with their distinct set of activities. For example, we identified a business process "Occurrences" that is related to the different events that may cause changes to the operational service of a bus. The activity list of this business process includes "Change Driver" and "Change Vehicle". Another example was the business process "Corrective Maintenance" that features activities such as "Repair of damage" and "Damage Report". These 10 business processes and respective activities are the ones that will constitute the foundation for the transactional data to be exported from the software being developed by Card4B for the public transportation industry.

As we stated before, we didn’t had access to real transactional data since the system is not in production yet. In this particular case, our tool will import transactional data from JSON web services rather than from a CSV file, enabling the costing tool to get data in real time. As a result, after configured, the costing tool can pull data, in a given time interval, so that it can produce updated metrics without user intervention.

In this demonstration, we explained how the costing service (and the costing tool) was used as part of a bigger and more complex project. This demonstration helped us highlighting the generic characteristics of the proposed service. Applying our service to a completely different industry shows how the costing service may be applied to other indus-
tries while providing the same features and benefits.

6. Evaluation

The goal of this evaluation is to determine if the solution proposed in the Proposal (section 4) solves the problem stated in the Problem (section 2).

The evaluation method will consist in the following steps:

1. **Interviews and Questionnaires**: Gather feedback from the proposal through the demonstration and identify improvements;

2. **Pries-Heje et al. Framework and Österle et al. Principles**: To formally evaluate the research;

3. **Demonstration Critical Review**: To critically evaluate the research, objectives fulfilment and the demonstrations conducted;

6.1. **Interviews and Questionnaires**

After demonstrating our costing service, we conducted a small questionnaire to those involved so that we could obtain a more structured feedback. The questionnaire was made to five interviewees with the following business roles:

- Planning, Quality and Audit Manager
- Budget Management
- Planning and Control
- Accountable for Client Support
- IT Director

We carried out six questions to these professionals that helped us assess the artefact utility and the fulfilment of the objectives defined earlier. These questions were also defined having in mind the needed information to formally evaluate the research.

The questionnaire results were very positive and provided us feedback in different topics needed to evaluate this research.

6.2. **Pries-Heje et al. Framework**

Alongside with DSR guidelines and to better evaluate research artefacts, [18] proposed five different types of evaluation methods: Observational, Analytical, Experimental, Testing and Descriptive. Even though the authors provided these evaluation paths, not much more guidance was given on how to accomplish them.

Considering prior research done in the area of DSR evaluation, [19] developed a framework to fill in this gap that could help researchers use and rigorously evaluate Design Science Research and its artefacts. This framework consists on distinguishing evaluation in two separated dimensions: one related to the form of the evaluation, the other concerns the moment of the evaluation.

Regarding the form of the evaluation, it can either be artificial or naturalistic. In an artificial evaluation, the solution is evaluated in a contrived and non-realistic way (using for example simulations, laboratory experiments and mathematical proofs). In a naturalistic evaluation, a solution’s performance is tested in real environments using real users, real systems and to solve real problems.

Concerning the moment of the evaluation, can be ex-ante or ex-post. **Ex-ante** means that the evaluation takes place before the artefact is developed, meaning that it is not absolutely necessary to construct an artefact to evaluate a theory. **Ex-post** means that when the evaluation is conducted the artefact is already developed. To further clarify, the artefact can be a design product or a design process.

In summary, there are three different aspects of a Design Science Research Evaluation [19]. In the case of our research, our evaluations have always addressed the three questions (What, How and When) the same way.

1. **What is actually evaluated?** The artefact evaluated is the costing service (a design product) proposed in (section 4). We evaluated the results achieved by creating the costing tool that instantiates the costing service, the feedback collected among academics and practitioners and the results of applying this system in practice, i.e., the three demonstrations performed;

2. **How is it evaluated?** The feedback gathered from experts and practitioners proved valuable to evaluate our proposal. We also implemented our proposal in three Portuguese organizations that represented a naturalistic evaluation since it was conducted using a real artefact, the costing tool.

3. **When was it evaluated?** In the case of our research the evaluation was made ex-post, i.e., after the development of the design product. We first developed the costing service tool and only afterwards proceed to obtain feedback from experts and practitioners.

6.3. **Österle et al. Principles**

Österle et al. proposes an evaluation method based within four principles [20]. Our research met the four principles of Österle. This evaluation is based on the feedback received from practitioners, which were described in the previous sections.
1. Abstraction: The artefact we propose (the costing service) can be applied to all types of service-oriented or process-based architecture organizations.

2. Originality: None of the interviewees had knowledge of any research or product similar to the proposed artefact. Similar research was not found in respect to the costing service.

3. Justification: Our artefact is justified by all the evaluations and positive feedback gathered during this research, as we emphasized in this section.

4. Benefit: According to the interviewees, at least in the industries consulted, there would be a valuable benefit, since it would provide an easier, more affordable and faster way to implement a costing methodology and conduct a cost analysis.

6.4. Demonstration Critical Review

We consider that our research was properly evaluated and tested with our demonstrations. We demonstrated our proposal in three Portuguese organizations, from two distinct industries, with the objective of providing those organizations with new ways to conduct simple and reliable cost analysis. The feedback gathered from the questionnaires and the formal evaluations from the previous sections validated the usefulness and the quality of the proposed costing service.

Our demonstrations targeted three organizations that are making clear efforts to consider business process costing a priority. Two of the three organizations (the service desks), already have their services oriented according to best practices such as ITIL and ISO 20000. That gave us an huge advantage regarding the costing service implementation. Although our service provides an easy way to start costing business processes and services, we do realize that the organizations deploying such service should have a considerable maturity in their architecture. Without such maturity the proposed service is much more difficult to deploy because of the lack of transactional data. However, since many organizations are already service-oriented, our costing service is a solution that delivers clear benefits to those organizations, as emphasized by the demonstration.

We were able to deliver average cost per business process and real cost per business process instance. We consider the latter to be a great benefit to service-oriented organizations since it enables organizations to comprehend the average cost of supplying a service or executing a business process but also the real cost for every business process instance executed. This helps organizations detect erroneous paths and singular problems that occurred at a moment in the organization. With this knowledge organizations know their real business process costs and also know when and why some execution costed them more. Afterwards, organizations may try to investigate the real cause of the problem, knowing exactly which transaction and activity generated the issue.

Finally, every interviewee that saw the costing service configuration and use from the beginning of the process till it’s end, considered the process of conducting a cost analysis using our tool very easy and understandable. This fact validated another objective aimed at providing a service that required low levels of expertise with both the service and costing methodology.

7. Conclusions

Cost efficiency has always been a major concern to organizations from all industries around the world. In recent years, economic crisis and increased competition in an increasingly global economy pushed even further the need for cost efficiency and cost awareness. It became crucial to assess and benchmark an organization’s performance and to identify improvement opportunities across all sectors of the organization and over the cost stream.

Our artefact is a cloud-based costing service meant to provide costing as a service. This means that our main objective was to develop a solution to reduce the costs associated with cost analysis so that SMEs can reach the accurate costing methodologies needed to assess an organization’s cost efficiency and performance.

We validated our proposal in three Portuguese organizations belonging to two different industries: Services industry (two Service Desks) and the Public Transportation industry. In all organizations we completed the demonstration by instantiating the proposed service using the developed costing tool.

7.1. Main Contributions

We believe that our proposal brings a valuable contribution in the context of costing and cost analysis. The resulting costing service allows organizations to conduct a bigger share of the cost analysis without demanding for significant levels of expertise or capital.

The proposed costing service not only provided a solution to the problem of high costs of cost analysis but also delivered a costing tool capable of correctly and completely support TDABC and Business Process Costs Templates. These methods combined with the capabilities of our costing tool produced well-defined steps that act as a guideline for both analysts and managers looking for a cost analysis
solution. The end result is costing service capable of delivering the ability for an organization to do cost analysis with internal resources and expertise, without needing substantial investment.

Both users and experts also evaluated the costing tool and the results obtained from the analysis using the costing service in the demonstration step. Interviewees considered that the costing tool would be more affordable and easier to use than those available today, making it a valuable contribution.

### 7.2. Communication

We conducted several presentations of the proposed service and costing tool to experts in the area and demonstrations to potential users. The audiences included the elements already mentioned in the Evaluation Chapter (section 6) and others such as IT Directors, Managers, Professors, Cost Accounting Professionals and Cost Consultants. The presentations made to these professionals resulted in further evaluation since we were always approached with more suggestions and improvement opportunities. Some of these presentations were made outside the scope of the research demonstration in order to show the value of our approach to several professionals interested in the area of costing. We would like to emphasize the interest shown by every interviewee, since they considered that the proposed service and costing tool deliver real benefits to SMEs.

### References


