

Templates for Calculating IT Services Costs

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Abstract. The majority of current and future business models are relying on the involvement of IT resources. Rapidly changing markets require a constant adaptation of business processes, which leads to higher requirements for IT. The crisis that affected most of the world's economy also forces organizations to stay efficient and competitive. The rapid growth of IT investments increased the pressure on managing IT costs for clearly weighing its benefits. However, it is a very difficult venture, not only because efficient costing methodologies are out of reach for most organizations but also because of the characteristics of IT Services. As a solution to this problem, we propose a model using business process templates to calculate IT Services costs and taking into account those characteristics. Finally, we will demonstrate the model through field studies and evaluate it through interviews, Moody and Shanks Framework, Österle principles and feedback from experts and practitioners.

Keywords: *Costing, IT Services, TDABC, Templates, ITIL, Business Processes*

1. Introduction

Over the past few decades, the importance of IT has grown every year in nearly every type of business [1]. As this importance rises, the need for managing its costs and performance also increases. We have seen how the global financial crisis forced organizations to be more cost conscious. Moreover, the economic environment will continue to affect the preponderance and cost of IT.

According to a study performed by IDC in Portugal, national organizations and consumers, faced with an unfavourable economic environment, have reduced spending on information technology about 1.6% in 2013 [2]. Another study made in Portugal confronted organizations with the question of what are the key steps to achieve organizational goals to outline economic crisis and become more competitive, and 90% of the organizations replied with cost information and reduction [3].

To obtain this cost information a number of methodologies were developed throughout the years. These methodologies come from the traditional accounting that evolved naturally to better take into account the impact of overhead costs on the total cost of products. This was where most methodologies failed [4]. This increased attention on overhead costs comes from the fact that the industry has evolved from manufacturing to services [5] and, with this transition, overhead costs have grown from residual to being the majority.

If we focus on IT Services, which are our domain of research, we can easily understand how difficult it is to calculate their costs, due to the overhead costs associated.

Even though there are methodologies that allow organizations to know what their real costs are, they require time, expertise and software that are out of reach for most of them. So, they have to use traditional accounting, which often leads to

unsupported or badly supported decisions which in turn lead to undesirable results.

As a response to the issues rose above, our research proposal is to use business process templates for calculating the costs of IT Services, following ITIL guidelines and using the Time-Driven Activity-Based Costing methodology.

To evaluate the solution we will use the results from the demonstrations, which were field studies in real organizations, and compare them to the objectives of the solution, through interviews and questionnaires; the Moody and Shanks Framework to evaluate the proposed artefact [6]; and the four principles proposed by Österle et al. will be used to evaluate the research [7].

2. Problem

This chapter corresponds to the first DSRM step: problem identification and motivation. We start by presenting the problems that raised awareness to this research and motivate their solution. Lastly, we present the question that was based on the problems defined and was used as guideline for our research.

In the aftermath of the global financial crisis, a perception took hold that a gradual but steady return to economic stability and growth was underway, so the business agenda of corporate boards shifted from cost reduction to growth [8]. However, over the last few years, business confidence has been shaken by a series of shocks, which combined with wider economic uncertainty put cost reduction back on the board agenda.

As one of enterprises' most significant areas of expenditure, IT is ever in the spotlight. Since 2009, cost reduction has been number one in the top 10 of IT Management concerns, except in 2011 due to an expected economic return [9]. As we may easily understand, there has been a continuous trend in lowering the IT budgets in the last years [10].

More and more IT is the backbone of global operations and an enabler of new revenue-generating capabilities, but needs to demonstrate its value in more meaningful ways to the business to justify investments in it [11]. The fast ongoing development of IT, along with the globalization trend, has had significant influence in the way organizations operate. These trends influence the corporate strategies and operational decisions of organizations.

As business users' expectations of IT continue to rise, many IT operations groups lack the business maturity to effectively demonstrate the business value of IT investments. It is difficult for IT to know the true costs of running their operations mainly because of the plethora of indirect costs associated with providing IT Services. Often, the costs are not directly linked with those services, but considered part of the overall costs of internal IT operations or possibly the broader company.

Although IT professionals' understanding of the business and the business's understanding of IT both need to be improved, to ensure strong IT and business alignment, business understanding of IT is weaker [12]. Questions such as "Why such a high budget for IT?" arise from the lack of understanding and demonstrate the dissatisfaction of their users. If the real costs are known then it is possible to justify the budget and the services' quality, clarifying business.

To gather that cost information organizations normally resort to Cost Accounting. The issue with traditional Cost Accounting is that its results have a very large granularity, not giving detailed information, and normally it is only focused on mandatory state-demanded reports [13]. When it comes to calculating the cost of a product or service, traditional methodologies provide inaccurate values, sometimes leading to bad decisions [4]. They are normally inaccurate because of a wrong distribution of overhead costs [5].

From all the issues raised, we can extract our research problem: **it is difficult to calculate IT Services costs with precision, easily and cheaply.**

The increasing importance of IT influences significantly the strategic, tactical and operational decisions of organizations [14]. This furthermore underlines that decision makers need appropriate tools and frameworks to ensure that the business really benefits from IT.

In this thesis our objective is to calculate the costs of IT Services with the intent of making the cost analysis simpler, affordable (both in capital as in expertise) and quicker.

3. Related Work

In this chapter we will present an overview of concepts, methods and tools that are available and could contribute to solve the identified problem, as well as other related work such as research done

about the subject, and in what aspects it differs from our proposal.

3.1 ITIL

The Information Technology Infrastructure Library (ITIL) was created by the Central Computer and Telecommunications Agency, an office of the British government, and was first released in the late eighties [15]. ITIL is a set of best practices for IT Service Management (ITSM) that focuses on aligning IT Services with the needs of business, and possesses the character of a branch standard [16].

ITIL provides guidance to organizations on how to use IT as a tool to facilitate change, transformation and growth of the business. While the first version was mainly based on experience in data centres running mainframes, in 2007 ITILv3 introduced the lifecycle principle, whereby the provisioning of services was considered to be a continuous process in which new services are brought into existence whilst others are phased out. The current version of ITIL covers the major weaknesses identified in the previous versions, namely being too focused on technology [17].

The ITIL core consists of five publications: Service Strategy, Design, Transition and Operation and Continual Service Improvement. It contains 26 processes, which help defining IT Services and ensure that they are provided in a focused and client-friendly manner.

3.2 Costing

In this section we will firstly start by providing an overview of Cost Accounting and its purpose. Afterwards we introduce IT Financial Management process, followed by the most relevant costing methodologies that were analysed through research.

3.2.1 Cost Accounting and Management

Cost Accounting is a systematic set of procedures for recording and reporting measurements of the cost of manufacturing goods and performing services in the aggregate and in detail. It includes methods for recognizing, classifying, allocating, aggregating and reporting such costs and comparing them with standard costs [18]. It provides the detailed cost information that management needs to control operations and plan for the future [19].

Management Accounting on the other hand is the activity developed by accounting and financial professionals to contribute to the design, evaluation and control of business processes in order for them to drive economic value. It emphasizes the use of the cost data for planning, control, and decision-making purposes [18].

Cost Accounting has seen for many years seen its popularity among organizations drop. This was caused by the intensification of reports demanded by law which made companies more focused on gathering information required to create those

reports, and then evolved to an analysis more focused on ratios and indicators [13].

3.2.2 IT Financial Management

IT Financial Management is a powerful process to improve service while lowering costs. It is the process of overseeing IT expenditures, with the goal of providing both business units and IT departments with a common framework to evaluate services and plan for future investments to optimize IT spending [20]. ITIL refers to this activity as Service Valuation, whereby each service is valued based on its cost and added value [21].

As technologies become more complex, the financial management of IT investments has proven challenging. Many IT organizations lack financial management experience. Similarly, business units often lack a clear understanding of the technology enabling a given IT service. As a result, many organizations find it challenging to develop a budget to expand a given service or charge for services. Many also lose opportunities to maximize their return on investment for IT resources [20].

The three basic IT Financial Management activities that an organization should have in place to cost-effectively deliver services that customers value are accounting, charging, and budgeting. These three activities are linked together through a continuous information flow. The IT budget predicts the budgeted amounts for the next periods, which the IT accounting process measures. The IT accounting process determines the cost of a given service, which provides necessary information to the charging process. As an organization's financial management process matures, these practices will become increasingly linked [20].

3.2.3 Activity-Based Costing

Activity-Based Costing (ABC) is a methodology that identifies the activities that a firm performs, and then assigns indirect costs to products. It was in the manufacturing sector of the U.S. during the 70s and 80s, that the first concepts of ABC were developed. It then was clearly defined by Robert S. Kaplan and W. Bruns [22].

The methodology aims to solve the problem related to the ability to trace overhead costs (e.g. Accounting, Marketing) to activities done within the organization that must reflect their cost on the organization's products and services. That is, those outputs give rise not only to functional activities that directly contribute to their production, such as manufacturing, but also to support activities that are needed inside the organization to support them.

ABC can be defined as having five main steps: identifying the activities performed by the company; calculate the costs associated with each activity for a financial period; identifying each activities' cost driver; calculate the rate of each cost driver using the average of each instance of the cost

driver; finally, divide the cost of each activity by products, according their cost drivers usage.

The main advantages about ABC are:

- Identifies activities that do not add value and cost reduction opportunities
- Details clients' profitability
- Allows more accurate decision making

On the other hand, the main disadvantages are:

- Need for lengthy and costly interviews and surveys to collect data required [23]
- Use of subjective and costly-to-validate time allocations
- As the activity dictionary expands the load on the computer model escalate dramatically

3.2.4 Time-Driven Activity-Based Costing

An alternative approach for estimating an ABC model, which is called Time-Driven Activity-Based Costing (TDABC), addresses the limitations described above. TDABC is a costing methodology developed to calculate the profitability of services/products with a strong emphasis on allocating overhead costs to these cost outputs. It is simpler, less costly, and faster to implement, and allows cost driver rates to be based on the practical capacity of the resources supplied [23].

Like its name suggests, TDABC is based on the cost of activities (inherited from ABC) unlike traditional methodologies that were normally linked only to products as a whole; therefore it is more flexible and provides more detailed information. To address simplicity, TDABC only requires values of two parameters: 1) Unit cost of a resource, that can be calculated from the total expenses related to that particular resource divided by its capacity (which is normally expressed in time) and; 2) Time required to perform a given task.

So, having these values, it is possible to calculate the cost of a particular activity by simply multiplying the time taken, which is the most used capacity unit, by the unit cost.

In terms of flexibility, TDABC introduces time-equations to solve the problem of ABC wherein each activity reflects only one factor/condition [24]. If in the latter for each small variation in an activity there was the need to create a new and independent activity, in TDABC linear equations are used to model the different times taken by an activity in each of the variations it can have and therefore the different consumption of resources.

Taking as an example a simplified IT Helpdesk incident resolving that takes longer if there is a need to do a survey to the requester. In ABC there would be two activities: one for standard resolving and one for resolving with a survey. In TDABC it is possible to express this with the following equation:

$$\begin{aligned} \text{Helpdesk incident} &= 15 + 4 * \gamma \\ \gamma &= 1 \text{ if logging } \cup \gamma = 0 \text{ otherwise} \quad (1) \end{aligned}$$

This equation represents that the time taken by the activity is 15 minutes (also called standard time) plus 4 in case of logging required. If we multiply the result of this equation by the unit cost of the department in which the activity is performed (e.g. User Support Department) we get the activity cost.

3.2.5 Process Templates

“Process templates” is an overarching term that describes prebuilt business process design, execution and management artefacts that accelerate time to solution. They are also known by various names, such as “solution frameworks,” “solution templates”, “starter kits,” or “process accelerators” [25]. Typically, process templates are graphical and are based on process flows, rules or service-oriented architecture (SOA).

Process templates are not intended to deliver 100% of a solution. Instead, they are meant to be changed by an implementer. A process template can be extended, that is, the implementer can add capability beyond what was provided by the original assets. They provide reusable process model structures that can also be adjusted or configured to accommodate unique requirements of a process.

They also serve as knowledge and resource of legacy systems for further reuse. Model template reuse improves the quality of process models by reflecting previous knowledge and experience preserved in them. To be useful and usable, a desired process template should be easily located and adapted in a new project [26].

4. Objectives

Recalling the main research problem, we stated that it is difficult to calculate IT Services costs with precision, easily and cheaply. We have seen, among other issues raised, that currently it requires expensive tools and consulting in order to analyse and calculate IT Services costs, making it unaffordable for a large part of organizations. The lack of transparency and visibility between IT and business users is also a critical issue, leading to a continued friction among them.

The main objective of this proposal is to present an instrument that enables IT Departments to better know their services real costs. So, we take advantage of the TDABC methodology and a language to model costs, following the guidelines provided by the ITIL best practice framework, to create templates that serve as an accelerator to calculate IT Services costs.

Outlining the objectives in a more detailed way, our model should not be specific to any IT Department, so it must be reusable for all. It should not require expertise upon its instantiation but only for minor modifications necessary. The model provided must be easily understandable and expressed in a clear notation for the people who

will use it, both on the IT and the business side. Transversal to these objectives there is obviously the underlying affordability requirement.

5. Proposal

We can briefly describe our proposal as being **business process templates for calculating the costs of IT Services with less effort, following ITIL guidelines and using the TDABC methodology**. To clarify the proposal sentence, we claim that the effort is less when compared to traditional costing methodologies as the ones explored in the related work chapter.

5.1 Thesis Boundaries

In the proposal sentence, the reference to ITIL guidelines is generic, so we need to clarify what parts of the framework will be used and why. As we have seen, the ITIL core is comprised of five books, and is then complemented with further literature. Above, we justified the use of ITIL Processes as basis for constructing costing processes templates. Even though our proposal is generic, it is impossible, in the scope of this thesis, to build templates for all ITIL processes, which currently are 26. Due to that, we had to choose those with more relevance within our research and, from those, pick the ones that represent most of the activities performed in IT Services.

To do that, we used the feedback received throughout the research from IT Departments’ staff, gathering the most mentioned and relevant processes implemented there. We also sought support in related literature, and found that processes such as Incident or Problem Management are amongst the most implemented and benefit ones [27], and in several ITIL implementation case studies they are referenced as the first to be implemented [28].

Gathered all the information, we chose Incident Management process, from the ITIL Service Operation book [30], to construct the costing process template. Incident Management is the process for dealing with all unplanned interruptions to an IT service or reduction in the quality of an IT service. Failure of a configuration item that has not yet impacted service is also an incident [30]. Examples of configuration items include individual requirements documents, software or hardware.

5.2 Costing Template

The design of the template started from studying ITIL literature, case studies and available research. Soon we could also start interacting with IT Departments, which gave us important feedback to validate and complete the template. The method proposed by Lourenço (2013) mentions the importance of analysing the industry field or area with detail, in order to encompass maximum information in the model. Moreover, this being the

first ITIL process cost template, thus exemplary, we try to integrate aspects of the whole.

The BPMN diagram below is a zoomed out vision of the ITIL Incident Management costing template.

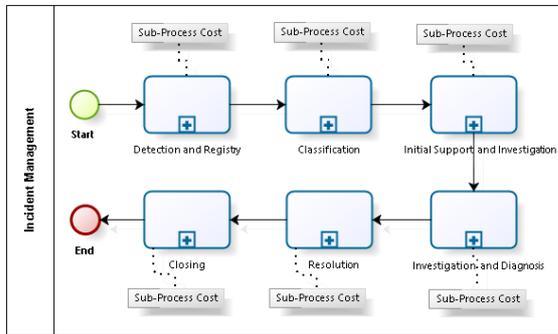


Figure 1 - ITIL Incident Management Process Top-level Costing Template

We grouped all the processes activities elicited into six macro activities, illustrating the most meaningful steps of this process. Each one of those is represented in this BPMN by a Subprocess that contains a set of activities, – in fact, an entire process segment.

With this top-level view of the template, we intend to illustrate the graphical notation used and its parallelism with the chosen costing methodology, as well as the ITIL guidance depicted in its activities. Now, we will drill down the Subprocesses, starting by the first one, to further explain the template.

The Incident Management process can be triggered in two different ways, upon detection of an incident: through Service Desk, by receiving and registering the request from users, or directly from technical staff, that registers it directly. In both cases, the Detection and Registry phase is concluded with the registry of the initial data of the incident in an appropriate system. The Subprocess is expanded below:

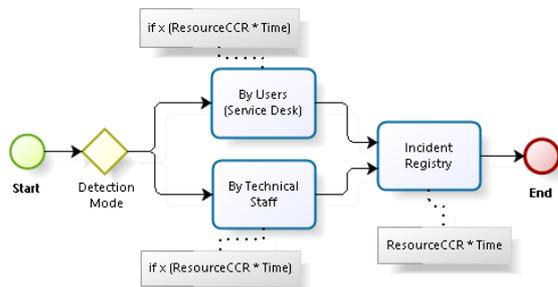


Figure 2 – Detection and Registry Subprocess

Here we introduce time-equation conditions in the template, which allow for calculating the cost of the process. Therefore we will proceed to explaining the cost notation in the diagram and how to obtain the values needed to fill the equation.

All activities have an associated condition that represents its cost. In two activities we can see that the condition starts with “if x”, which means that

the activity might happen or not. Before those activities there is an Exclusive Gateway, used to create alternative paths within a process flow, and only one of them can be taken.

The “ResourceCCR” parameter is the Capacity Cost Rate of a given resource, which is its cost per a given unit of time (per minute, hour, etc.). To calculate the CCR for a resource, we need the its cost for a given period, for example the monthly salary, divided by the provided capacity in that given period, such as monthly work hours.

After obtaining the “ResourceCCR” parameter, we need the other, “Time”, which, as expected, is the time it took to complete activity. It should be transactional, that is, the time is should be counted every time an activity is executed, in order to report the most reliable cost possible. However, not all departments have that possibility, because they lack appropriate software. In that case, the time should be estimated, through observation, possible historic data and feedback from staff.

Adding the cost of each activity we obtain the total cost of this process’ segment, and the first step towards calculating Incident Management is complete. The template, by definition, can be extended or adjusted, so it can encompass the particular requirements of each IT Department. Nevertheless, we must have in mind that it was created having ITIL as reference and guide.

Since the remaining Subprocesses of the template contain similar structure, they will be in the Annex section; otherwise the proposal would be very extensive. To conclude this part of the proposal presentation we briefly discuss its application phase, where it is instantiated for a specific IT Department, recapitulating and organizing steps of this phase that were explained along this proposal.

5.3 Template Application

First of all, the resources used in the department must be identified and an allocation tree that represents how they organize themselves into resource pools must be created. Total cost and practical capacity for each resource should then be gathered in order to apply them in the template. After gathering the specific resource costs, applying the template consists on instantiate the processes, activities and time-equations. Adjustments to adapt the template for the characteristics of each IT Department must be done.

Cost calculations are made using the rules defined by the TDABC methodology. To run the model, the method receives as input data from transactions that is needed for the time-equation variables defined in the modelling phase. Finally, a component of control that aims to continuously improve the quality of the process must exist. Upon each application the responsible staff can give feedback in order to improve the model.

We may face different department maturity levels regarding process definition, ranging from no processes defined at all to processes defined according to ITIL. If no processes are defined, the template serves as an incentive for documenting them, since it can then be monitored, managed, and improved. Another possibility is that the processes are defined, having some representation, but not following ITIL. In this case, the activities that compose them must be mapped to those in the template, which may be only a matter of nomenclature and structure.

In both cases, and for all departments that do not have ITIL processes implemented, the template carries added value, because of the proven benefits that the best practice brings. If the department already implemented ITIL processes then the model is applied in order to add costing to them.

6. Demonstrations

This chapter corresponds to the demonstration step of DSRM in which we will demonstrate that the proposal of the previous chapter can be used to solve the problem stated on Chapter 3. The way we chose to demonstrate our proposal was through field studies, where we monitor and exercise the use of the artefact in multiple projects [30].

In order to demonstrate our proposal we intended to calculate the costs of incidents of a certain period of time, by using the proposed template for Incident Management process, thus validating it, in two organizations: Social Security Informatics Institute, I.P. and Defence Data Centre. The demonstrations consisted in instantiating the template in their IT Departments, in particular on user support, from gathering and grouping resources into pools, costing the incidents, to mapping their Incident Management process with our template.

In each of the two demonstrations, we start by motivating for the choice of the particular organization and what was the purpose for performing them. It is then necessary to explain the process of obtaining the required data for filling the template, relating to proposal concepts in a practical way, which helps, in our view, to complement it.

6.1 Social Security Informatics Institute, I.P.

The Social Security Informatics Institute, I. P. (SSII) is a public institute, integrated in indirect state administration, with administrative and financial autonomy and with own assets. Focusing on the Service Desk of the Institute, where the Incident Management process is performed, it is a single point of contact between service providers and users. Its main objective is to manage, coordinate and resolve incidents as quickly as possible, ensuring that no request is lost, forgotten or ignored [31].

Having collaborated various times with our research group, the Institute emerged as a strong

possibility for demonstrating the proposal, since it has a strong background and maturity in IT Service Management (ITSM) and proper ITSM Software (EasyVista). The Institute also has its business processes defined and documented, with ITIL and ISO20000 as reference, so it was also interesting to compare, validate, and map with the template.

Undoubtedly, the contribution which was more interesting and expected for the Institute was to have the cost of incidents calculated, because there were no current means for doing proper costing of incidents, even more if done individually. Having embraced the challenge, we began the process of collecting the data necessary to perform the costing of Incident Management process.

The first step in cost analysis is to gather the resources and resource pools that are involved in the execution of the User Support Department processes and activities. The department is responsible for all the incidents and service requests, through its Service Desk. As one would expect, there are a large number of resources involved in performing the functions of the organization, divided among direct and indirect costs. Internal labour, contract costs and infrastructure costs compose direct costs, while expenses from administrative areas, general staff and Institute compose indirect costs.

Within the User Support Department, we needed the cost of user support technicians and their provided capacity. The provided monthly capacity of the resource was 8 hours per day and 22 days per month, with an estimated 90% of practical capacity as was suggested by the Institute. Dividing the monthly cost by monthly practical capacity, we obtain the CCR of this resource, which is 0.46€ per minute. Having obtained this rate, we can move toward costing of the Institutes' incidents.

We were given 477 Incident Management process instances, from 61 different incident categories. We mapped a number of those instances, of different incident categories, with our template, in order to verify their resemblance and fitting. We will then present an example of instance and its activities mapped with the macro activities of the template.

$$\begin{array}{c}
 \text{Detection and Registry} \qquad \text{Classification} \qquad \text{ISI + ID} \\
 \text{DesktopICD} = \text{SelfService} + \text{OpeningEmail} + \text{Email} + \text{Classification} + \text{Changes} + \text{Email} \\
 + \text{Travel}(\text{CCR} * 120) + \text{Changes} + \text{Closing}(\text{CCR} * 30) = (\text{CCR} * 150) = 69\text{€} \\
 \text{Resolution}
 \end{array}$$

Equation 2 – SSII Desktop Incident

In this example, several activities have time equal to zero (when they don't have $CCR * time$), since not all have it associated yet. Until now, the "Closing" activities' time is an estimate for all the activities that don't have an associated time, allowing a better approximation for costing.

Each one of the activities of the Incident Management template is represented in these instances, in a more or less extensive way. After doing the mappings, we validated them with User Support Department, which helped us to better group activities which were not very perceptible and gave us positive feedback about the template. Therefore, it seemed to be rather comprehensive and complete, plus easy to understand and use.

Having information such as this, the User Support Department can better know the true costs of its Service Desk, identifying possible inefficient activities as well as cost reduction opportunities, allowing more accurate decision making. The departments' management staff found the model and results very useful, since it enables costing by each activity, incident category and, eventually, final client, which allows to make interesting comparisons and improvements. This demonstration raised awareness and interest in applying the same model to other ITIL processes executed in the department, progressively.

6.2 Defence Data Centre

The Defence Data Centre (DDC) is part of the General Secretary of the Ministry of National Defence and has under its domain several duties to ensure IT Services to all organisms of the Defence. After presenting the topic of research and proposal to an IT Director of the Centre that has a close relationship with our research group, arose a mutual interest of doing a demonstration. With results already obtained from the prior demonstration, it was motivating for the director to apply the same methodology with incidents data from its User Support Department.

Just as the first demonstration, the User Support also uses EasyVista software, and its processes are defined according to ITIL best practice. The size of the organizations is also similar, although we had access to a larger number of Incident Management process instances in this demonstration. Therefore, because the basis for the demonstration was quite similar to the first, the application of our template was faster and more structured.

Once again we start by gathering the resources and aggregating them in relevant resource pools involved in the execution of the Incident Management process, direct or indirectly. In this organization the cost structure was more complex, with nine functional resource pools plus three support resource pools, which we now detail.

The CDD contains two departments that have responsibilities over Incident Management process, depending on incident category. "CDD", which has four functional resource pools and "DSSI", which has five, each one with a particular group of incident categories ownership assigned. Those resource pools aggregate human resources but, contrary to the first demonstration, the indirect

costs associated to them are not included on the resource pool costs that we were given. Therefore, the indirect costs were aggregated in separate support resource pools, depending if they are applicable only to one of the departments or they are general, therefore applicable to both.

Having the cost structure complete we move towards calculating the CCR's of resource pools. For that, we used the same capacity measure as in the first demonstration (8 hours per day, 22 days per month), with 90% of practical capacity. As explained above, there are nine different functional resource pools so there will be equally different cost rates, according to the cost of the resources that compose each. With those costs we could obtain the CCR for each resource pool.

We had access to 1329 Incident Management process instances in this demonstration, from 204 different incident categories. As in the first demonstration, we mapped a number of instances, of various incident categories, with our template. We will present one example of instance and its activities mapped with the template.

As well as in the first demonstration, several activities have time equal to zero, in fact all but the last. The "UserValidation" activities' time is an estimate for those activities, allowing a better approximation for costing. It is interesting to notice the differences of the processes configuration, using the same software, between the two organizations.

$$\begin{array}{c}
 \text{D\&R + Classification} \qquad \qquad \text{Initial Support and Investigation} \\
 \text{DesktopICD} = \text{EmailSupport} + \text{Processing} + \text{EmailRequester} + \text{Wait} + \text{FinishWait} + \text{Investigate} + \\
 \text{Diagnose} + \text{EmailRequester} + \text{UserValidation}(\text{UserSupportCCR} * 20.8) = 9.8\text{€} \\
 \text{Investigation and Diagnosis} \qquad \qquad \text{Resolution + Closing}
 \end{array}$$

Equation 3 – CDD Desktop Incident

Once again, our template was represented in the organizations' instances, sometimes with grouped activities. Validating the mappings with the User Support department allowed us to better understand the incident structure created and how, although having a large activity dictionary, their workflows are practically the same, with the same common basis of our template. DDC staff, among management and user support technicians, found the template to be complete and clear thus representing Incident Management process with its associated costs.

By materializing time into cost, the application of the template, and therefore the underlying costing methodology, warned the organization about certain inefficiencies, such as repetitive tasks of the same category which do not reduce the time of following instances, indicating possible communication and documentation failures. The possibility of updating the business processes and readily obtaining the costs changes reflected was highly valued by the staff, given the volatility of the business.

Visualizing templates as accelerators for costing ITSM processes was seen by the organization as an innovative and interesting way of addressing the issue, bringing added value to organizations, independently of its maturity in the subject. It was then interesting to verify the contribution of the demonstration not only through the Incident Management process template, but as a starter of a generic application for costing IT Services.

7. Evaluation

This chapter corresponds to the evaluation step of DSRM in which we compare the results of the demonstration (Chapter 6) with the objectives of the solution (Chapter 4), to demonstrate the model's utility, quality, and efficacy.

In order to fulfil those methods, we will explore the following evaluation perspectives:

- **Demonstrations:** evaluate the proposal through its demonstration, with the feedback and critics obtained;
- **Interviews:** collect feedback and quantitative data of the proposed model through approaching the staff involved in the demonstration, among other participants;
- **Moody and Shanks Quality Management Framework:** assess the quality of the produced model;
- **Österle et al. principles:** to evaluate research done focusing on its rigor.

7.1 Demonstrations

The evaluation of the demonstrations acquired major importance, as it provided essential input in order to continuously improve our proposal. The purpose of evaluating the demonstrations is to validate whether it served to test and to say that our proposal is valid to solve the problem identified.

Our proposal was demonstrated in two organizations, more specifically in their IT Departments, with the goal of costing the Incident Management process in order to exemplify our model for quick, simple and accurate IT Services costing. We can consider that our proposal was assessed and validated properly, through our demonstrations.

The two organizations are mature regarding ITSM, being process-oriented, which allowed to demonstrate the full capabilities of the costing methodology used, through costing every incident occurrence in a given time interval. Both organizations are pursuing better costing, emphasizing Incident Management as prone to be one of the first because of the data present on the ITSM software used by them, allowing for the better use of the methodology.

At the end of the demonstrations, it was noticeable a clear interest in having the costing of more processes, such as Change Management, Project Management, Application Management,

among others, in order to complete the ITIL Life Cycle. Within the scope of this thesis it was not possible to create more templates, due to several constraints and because our proposal is generic, therefore it would not add great value for the purpose of the thesis.

We were able to calculate the cost of each incident instance in both organizations, which allows for extraction and analysis of information with proven benefits, such as detecting hidden costs, highlighting pain points, among others. Therefore, our model can fulfil the main objective of knowing IT Services real costs to their providers. The growing pervasiveness of IT makes the proposal more relevant and interesting for organizations. Having a clear and understandable notation, requiring no or few expertise to apply it properly and allowing for quick and accurate costing make the proposal a valid approach for IT Departments, from lower to higher maturity.

7.2 Interviews

After demonstrating the proposed model, its application and the results, we conducted a small questionnaire to those involved so that we could obtain more structured feedback. We had six interviewees that completed the questionnaire, with the following roles:

- IT Director
- User Support Responsible
- Planning, Quality and Auditing Manager
- Project Manager
- IT Budget Manager
- IT Infrastructure Director

These interview sessions and questionnaires gave us very important feedback in order to evaluate our proposal. We now turn to a more formal evaluation, using a quality framework and characterizing principles for research with the thesis.

7.3 Moody and Shanks Framework

Moody and Shanks Quality Management Framework (MSQMF) is the result of research on how to evaluate and improve the quality of models from the perspective of the multiple stakeholders. After performing the demonstrations, we obtained the following results by applying Quality Management Framework to our proposal. We also took into account interviews and contributions of professionals. The evaluation results are:

- **Completeness:** The proposed model is complete since the templates that can be produced, based on ITIL processes, encompass the activities done in each IT Department, namely in IT Services. If the template needs adjustments, the department should do them in the application phase, according to what are its specificities.

- **Integrity:** Since the templates are based on ITIL best practices, the proposal fulfils this

factor. However, while applying the templates, namely in changing activities or time-equations, it may not properly cover the processes execution in a given organization or errors can be introduced. As the template is improved, we believe those possible errors are mitigated, incrementally.

- **Flexibility:** The ability of reflecting changes is achieved mainly by the use of time-equations, therefore allowing adjustments on the model, being also one of the major objectives of the proposal.

- **Correctness:** The proposal was considered valid by the practitioners who collaborated and evaluated it; however the accuracy of costing is dependent on each organization, as explained in the integrity factor.

- **Simplicity:** According to the practitioners the model is simple to use, and what we verified is that it is simple to apply the template and reflect the needed changes. The Incident Management template provided as example was recognized to contribute to this aspect, having the minimum basis activities as desirable.

- **Integration:** The model is consistent with the rest of the organization because it represents a part of the organization itself. Since it is not static, it is easy to integrate it in different realities, depending on organizational characteristics.

- **Implementability:** Implementability is solely dependent on the information available. The basic information needed for the models must be registered as enforced by law, but for more in-depth analysis other information is needed. It was observed that sometimes this information exists, but it is not available through an IT system.

7.4 Österle et al. Principles

These principles result from a memorandum written with the intent to set a way to characterize design-oriented IS research and distinguish it from solutions from practitioners or commercial providers. In sum it tries to provide a contribution to the rigor of research. We applied the proposed four principles to evaluate our artifact [6]. The evaluation results are:

- **Abstraction:** The model we propose can be applied to all IT Departments in the context of IT Services, having ITIL implemented or not, therefore process driven organizations.

- **Originality:** Although there were interviewees who knew of some way a similar model of using templates for process costing, they are inserted in non-specialized “big-bang” software, not having our proposal objectives and characteristics.

- **Justification:** The artefact is supported by the related work, by its theoretical background (TDABC + BPMN + ITIL), and by all the

evaluations and positive feedback gathered along the research.

- **Benefit:** According to the interviewees there would be valuable benefit, since it would provide an easier, flexible and faster to implement costing and allow for proper analysis. This was also confirmed by the results obtained from our demonstrations, where we were able to provide valuable insights to the addressed organizations using the proposed model, and by all interviewees affirming they would use the proposal.

8. Conclusion

The importance of IT in almost all types of business is growing increasingly, and that growth requires proper cost and performance management. The financial crisis raised even more concerns about cost analysis and reduction, which are vital to assess an organization's performance, identify points of improvement and increase efficiency. The issue is that not all cost analysis produce the desired effects and those that do are out of reach for many organizations. IT Services costs are particularly difficult to calculate; therefore, to improve performance, organizations need to cut costs, but to do that they have to spend money they do not have.

Our research was conducted using DSRM that provided us with a nominal process and a mental model to carry it through. We started by identifying the problem and then analysed the methods available to us both in what concerned costs and in what concerned modelling and best practices within IT Services. From this analysis we made the choice of developing our artefact using TDABC with BPMN, having ITIL as guidance. With these, we propose business process templates for calculating the costs of IT Services with less effort than the existing methodologies, in a more agile way.

To assess the usefulness of our model we demonstrated it in two IT Departments of public institutions, which consisted in instantiating the template on user support, from gathering and grouping resources into pools, costing the incidents, to mapping their Incident Management process with our template. Following these demonstrations we evaluated the proposal from several points of view.

We presented our solution to academics, practitioners and experts of the concepts included in the proposal, such as those mentioned in the Evaluation chapter. The collected feedback was incorporated in the thesis and also allowed to reflect upon its limitations. We believe the main expected contribution of the thesis to be the model itself, because it will serve as an accelerator in calculating IT Services costs, reducing costs if the cost analysis required expertise. Regarding future steps we believe that applying the proposal to more organizations with different complexities and with various processes, for example, would be valuable.

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