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# PROCESS COMPLEXITY SCORE: Method for Estimating Business Process Modeling Costs

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## ABSTRACT

*The understanding of business processes is an obligatory point for all contemporary proposals of organizational change. In order to execute it, organizations have been employing a considerable quantity or resources, especially people. However, there are no specific methods for pre-evaluating process modeling costs. This makes decision makers uneasy, who fear repeating prior shortcomings. This paper proposes a methodology for evaluating resources an organization will need to employ to model its business processes, based on the process' intrinsic complexity and on the training of the team involved. This methodology has been applied in several real cases, making it possible to generate proposals for more realistic services, which have facilitated decision-making on investments in process modeling.*

**Keywords:** *process, modeling process, business process management, business process.*

## HIGHLIGHTS

> Organizations have difficulty in estimating process modeling project costs. > This hampers the implementation and contracting of modeling services. > It was structured with a set of control items and tested intensively in a set of organizations. > After analyzing all the tests, we concluded that the method developed permits measuring control items in practice and estimating costs in modeling processes.

## 1. INTRODUCTION

Understanding business processes is an obligatory step for Business Process Management (BPM) and, in general, for all contemporary management techniques: SOX, ABC Costing, Six Sigma, ISO 9000, Balanced Scorecard, etc. However, specialized literature describes errors frequently committed by modeling teams: forget the purposes targeted by the modeling sponsor (LIN, YANG & PAI, 2002); have diverse views of a same type of process (DAVENPORT, 2005); stick to failures in previous projects (SMITH & FINGAR, 2003); trust radical changes excessively, such as reengineering (MELÃO & PIDD, 2000). These errors lead to numerous failed modelings, jeopardizing important projects for organizational change. In order to protect themselves from these problems, organizations tend to increase the size of modeling teams. This option generates a new risk: the modeling team loses the perspective that modeling is just a means for organizational restructuring and begins to treat it as an end in itself; with that, it ends up wasting too much time in unnecessary details (JACKA & KELLER, 2002). The results remain unsatisfactory and, what is worse, now generate high costs.

How can you precisely define the size and competences a team must have to model a given number of business processes in a short period? The answer to that question is decisive for estimating total cost of the process-modeling project, because it basically corresponds to team compensation, since modeling is an essentially knowledge-intensive activity. In organization practice, modeling cost is given by the number of work hours corresponding to each function (for example, conduct interviews or redesign processes in specific software), multiplied by the respective value for the work hour. In some cases, a same person performs different functions in modeling and, therefore, different values for the hours worked are attributed (SOLIMAN, 1998). Although we can use techniques for shortening modeling, such as adopting best practices (REIJERS & MANSAR, 2005), the basis for these calculations is usually provided by similar projects the organization executed before, through internal teams or through external consultancies.

Therefore, a fundamental activity for organizational change is administered based on empirical methods, belonging to each organization and insufficient for guaranteeing safe results. This situation raises significant economic uncertainties. Transaction costs among organizations can be significantly reduced if the uncertainty and diversity in methods could be eliminated. Indeed, several authors have been underscoring an urgent need for standardizing all approaches and methodologies that interfere in business (GUDMUNDSSON, BOERAND & CORSO, 2004), which includes, evidently, the cases of process modeling dealt with herein.

## 2. BUSINESS PROCESS MANAGEMENT

The means used by companies to supply products (goods and services) to their clients are the operations, the projects and the processes. When performed repeatedly, they become processes. Thus, all companies have processes (SMART, MADDERN & MAULL, 2009). The processes can be managed either meticulously (modeled, known, defined, appointed, etc.) or, sometimes, unnoticeably; sometimes clearly structured other ambiguously.

Although some authors have a limited understanding of Business Process Management-BPM as a tool to model and execute processes, BPM can be understood in a broader way including other areas of the organization such as culture, governance, or strategic alignment (NIEHAVES, PLATTFAUT & BECKER, 2013). BPM can also be considered as a continuous, structured, analytical and multi-sectorial improvement of processes which possess several critical factors (TRKMAN, 2010), and to which several critical practices are associated allowing the organizations to become highly business process oriented (SKRINJAR & TRKMAN, 2013). BPM requires a systemic thought, a balanced vision as the business process connects the organization and implies a correspondence and balance of resources such as people, processes and systems. BPM initiatives require the identification of a niche area so as to focus on these processes which are critical and aligned with the goals and strategies of the organization (SIRIRAM, 2012).

In general BPM is applied to services. As signaled by Osborne, Radnor and Nasi (2012), there are three characteristics of services which are traditionally referenced: intangibility, simultaneity between its production and consumption, and the user as co-producer of the service. These aspects of services make it difficult to monitor and measure results, and the consequent quality improvement. (PYON, WOO & PARK, 2011).

According to Atesci et al (2010) the standardization of procedures is a way to reach efficient/effective knowledge transfer methods, and the monitoring of this action is essential to knowledge consolidation. However, standardization becomes difficult when the different business processes forming the main business process have different people in charge of them (VAN NUFFEL & DE BACKER, 2012).

Business Process Management-BPM is the best known method regarding process management. Segatto, Dallavalle and Martinelli (2013) compiled BPM as a subject directed to organizational management processes whose focus is process management and continuous improvement – which are determining factors in the performance of the organization. The correct reading of the processes by the concerned people in the organizations is a decisive factor for the successful implementation of these processes and BPM continuous improvement (SKRINJAR & TRKMAN 2013).

As process management involves dealing with risks, it is important to adopt a resilient BPM to support dynamic and unstable changes in the system taking it to normality after going through abnormal conditions (ANTUNES & MOURÃO, 2011). Organizational capacity to be resilient is a multilevel collective attribute emerging from individuals and organizational unites action capabilities and interactions (DINH et al, 2012). For public organizations the level of flexibility of their processes determines which laws can be implemented within a certain period of time, which becomes crucial when policies are implemented under constant change (GONG & JANSSEN, 2012).

Organizations are also recognizing that workflow management systems need to be ready to efficiently adapt to business changes. In order to provide systematic support to process continuous improvement there is a critical need of managing workflow changes in a more rigorous way (WANG & ZHAO, 2011). The optimization of business processes, according to Vergidis, Saxen and Tiwari (2012), is a new area which provides a formal methodology for the improvement of business processes based on specific goals. The authors adopted a multiple goals optimization approach because of the myriad of factors which can be used to evaluate a business process.

Processes improvement may result in their remodeling, which can be done cautiously, in a decentralized way, and to a certain extent. Turetken & Demirors (2011) noticed that in case the organization has already achieved a high level of process maturity, this decentralization makes it possible for process changes to be carried out by the users themselves, increasing people's involvement, which boost problem solving and process improvement.

Therefore, the organization needs to understand the phases of its process in order to optimize them (DUBANI, SOH & SEELING, 2010), and it is of vital importance to develop management awareness to the dissemination of a process management oriented culture. Several business process modeling tools have been developed for the understanding of how the processes articulate with one another and generate value (DIJKMAN, LA ROSA & REIJERS, 2012).

## 3. RESEARCH PROPOSAL

The basis for the method proposed is that precision in the pre-evaluation of modeling costs is associated with factors that determine the complexity of a business process. The greater the complexity, the difficult modeling will be and, consequently, the greater the necessary number of hours worked.

Therefore, elaboration of the method began by defining process complexity factors. In order to identify them, 14 process-modeling projects performed by SAGE (Laboratory of the Federal University of Rio de Janeiro that works with process modeling) and by Federal Institute of the Espírito Santo were analyzed. These projects lasted from three to sixteen months and were all conducted between 1999 and 2014.

To start, each of these projects had its modeling team estimated in accordance with a given set of factors, defined by researchers, based on available literature and on its experience (cf. Table 1). When the project ended, researchers proved *ex post* which factors had indeed provoked strong consumption of team modeling time. The letter D (Determinant) and the others with the letters ND (Not Determinant) indicated the factors that decisively interfered in modeling project time. The criterion was the proportion of total modeling work time the project execution team decided it could attribute to the factor in question.

Since the project analysis was sequential, researchers could make the set of factors evolve, in a controlled manner, throughout the research period. The factors that in the beginning of the analysis proved to have little influence were removed from the set. They are the last four factors listed in Table 1:

K - work time needed to raise the process performance indicators: this factor was abandoned because first, it is too difficult to define which control items will meet the desired performance indicators beforehand. Second, it is relatively simple to verify the points where it is feasible to measure a control item during the process analysis.

L - work time needed to describe process events: this factor was abandoned because, by rule of thumb, each activity is associated with some event. Thus, this factor can be inserted in the activity description time.

M - the resources needed (equipment, software, persons involved, etc.) are obtained from the activity description and do not interfere decisively in modeling time consumption.

N - it was not possible to observe additional time consumption for validating data, except as a dependent variable for data actually collected.

Other factors (D, E, H and I) were, on the other hand, incorporated during the research. At the end of the analysis, the set was comprised of the following factors:

A - number of existing functional roles in the process;
B - number of activities executed in the process;
C - number of data inputs and outputs;
D - number of persons who intervene in the process (which is not necessarily equal to the number of functional roles: at a large call center, for example, the "attendant" functional role is occupied by hundreds of people);
E - time spent on execution of a process cycle;
F - type of desired modeling (functional or behavioral);
G - degree of difficulty in executing the current process;
H - pre-existence of process documentation;
I - current status of the process (active or inactive);
J - effort needed to generate the “to be” process;

In short, our research concluded this is the set of decisive factors in defining the time needed for modeling a given process.

Now, it was necessary to raise the values assumed in each of the 14 modeling projects by these factors. This made it possible to elaborate Table 2, which shows the scale of factor values.

With the list of factors and their respective value scale, we can calculate the degree of complexity of the processes to be modeled and, consequently, define the team and modeling project period. The following item will present the methodology suggested, in its entirety.

**4. THE PROPOSED METHOD FOR PROCESS MODELING**

The suggested methodology considers each process modeling as a specific project. Its objective is to define the quantity of resources (in this case, basically human resources) to be allocated to the project. It encompasses the following steps:

1. Elaboration of a global process diagram identifying the processes and sub-processes which are the objects of the study.
2. Raise the number of work hours needed for modeling each process represented in the diagram, using the set of previously defined factors for complexity.
3. Creation of the detailed WBS (Work Breakdown Structure) that will give the sponsor a complete perspective of resources needed for the desired process modeling.

The information needed shall be obtained in meetings with those involved in the project (project manager, department managers, specialists, information technology team). It is fundamental to take into account that those involved normally have very little time. Furthermore, they do not have in-depth knowledge of process modeling techniques and do not necessarily have a holistic perspective of the business. One should not underestimate the difficulty in extracting the desired results from these meetings (JACKA & KELLER, 2002).

The proposed methodology suggests the meetings should assume an open interview format and not a closed questionnaire format. A closed questionnaire ignores the contingencies of holding meetings and tries to force an idealized condition by the team that created it. Furthermore, those involved frequently pass them on for another person to answer them. Better results are generally obtained using interviews. They are based on simple scripts with the meeting objectives, providing them with a more natural progression. In them, those involved can present values and different perceptions with greater fluency and freedom of reasoning than in response to questionnaires. Nevertheless, it is worth underscoring that the interviewee's verbalization is just a cutout of his or her thoughts. In more complex cases, Discourse Analysis techniques (BROWN & LEVINSON, 1987; ZARIFIAN, 1996; VAN DIJK, 2002) can be valuable tools for interviewers.

*4.1 Construction and analysis of the global process diagram*

The first step aims to identify the processes and sub-processes to be modeled. It must be underscored that the number of sub-processes is a decisive variable for evaluating the degree of effort demanded by the modeling.

For such, one should create a global process diagram, describing the various sub-processes and the main standards for relationships among them, but without going into details (HARRINGTON, ESSELING & NIMWEGEN, 1997). This diagram should no represent procedures or data flows, but just indicate processes and sub-processes in a given order. If a given process still does not have a specific name, it should be created at this time.

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Common starting points for modeling projects are the existing organizational structure or the products desired by the process to be defined. They strongly influence the vision those involved in the project (including the modelers) have of each process.

Elaboration of the global diagram is also subject to the same diversity of guidelines that generally govern all modeling and process simulation: oriented to the product, user, process, task or order (ZÜLCH & BRINKMEIR, 2003). Elaboration of the global diagram can be supported, for example:

- on the Value Chain technique, created originally to identify macro processes in a strategic focus (PORTER, 1985);
- on the Process Classification Framework elaborated by the APQC (2010);
- on the classification elaborated by TM Forum (2010);
- on the classification recommended by Harrington, Esseling and Nimwegen (1997);

They all create a two-pronged framework: allow those involved to easily perceive correlations between the processes and provide a perspective (even if simplified) of the positioning of those processes under study in relation to other existing ones at the organization.

*4.2 Calculation of the number of work hours needed for modeling each process*

Using the set of complexity factors described in Section 2, calculate the Process Complexity Score for each process identified in the global diagram. The data needed are obtained through specific interviews with those involved in executing the process. Normally, each process to be modeled requires a meeting that lasts on average ten minutes (value extracted from the research mentioned in Section 2).

4.2.1 Raising data on processes

For elaborating interview scripts, take into account the following aspects:

- Factor A (number of existing functional roles in the process): at organizations that do not adopt any form of BPM it is rate for those interviewed to adequately describe the structure of functional roles in processes, especially if these processes cross several departments (KUMAR & STREHLOW, 2004). In order to get around this problem, the interview script should include two pieces of information: how many different people need to work for the process to be executed? How many times does each person intervene in the process? Observe that, it is not rare for a process to go through the hands of a same person several times before conclusion. Furthermore, a same person may execute more than one functional role within a process. Thus, the number of functional roles will always be bigger than or equal to the number of people involved in a process instance and less than or equal to the number of times the people intervene in the process. At a call center, for example, hundreds of people may be working on thousands of instances of one type of sub-process, but only a few work on a single instance of a specific sub-process. Clearly, the number of functional roles in a given sub-process may be altered in an eventual future modeling to be of the process.
- Factor B (number of activities executed in the process): in general, those interviewed can provide us the number of activities in a process. If this does not occur, it should be assumed that the number of activities executed in the process is greater than or equal to the number of times people intervene in the process.
- Factor C (number of data inputs and outputs): serves as an approximation of the number of documents, forms and screen versions of a system needed for process execution or its automation. Documents from a prior process, if they exist, can provide this value. If it is possible to evaluate the number of data inputs and outputs directly, the number of tasks can be used as a reference, disregarding those cases in which a given task has various data inputs and outputs.
- Factor D (number of people whose tasks drive them to intervene in the analyzed process): this factor is very important because the greater the number of people involved, the greater the possibility for suggestions and for alterations that will demand successive reviews during the future process modeling.
- Factor E (average execution time for a process instance): the greater the execution time for a process instance from beginning to end, the harder it will be to control the quality of the future *as is* modeling of the process (that is, attest that the modeling corresponds to process reality). If other information is lacking, assume that the minimum value for this variable is one day.
- Factor F (type of desired modeling): future modeling can be functional, behavioral, or both, depending on its purpose. Functional modeling is generally preferred (such as BPMN - Business Process Modeling Notation), because its focus on activities and functional roles enables them to accompany and elaborate training material and discussion. The behavioral model, in turn, is very useful for implementing computerized systems, ERPs, Workflow systems, etc., because it focuses

on events that occurred and on the information that characterizes it (where it is even possible to convert modeling to a UML - Unified Modeling Language or equivalent).

- Factor G (degree of difficulty in executing the current process): it is important to capture the perception of people executing the process (who tend to underscore its complexity) or their immediate superiors (who tend to underestimate it). Eventually, both perceptions can present distorted perspectives of process efficiency (GRAHAM JUNIOR, 1995).
- Factor H (pre-existence of process documentation): even if the analyzed process is not adequately documented, other sources can facilitate its understanding and, consequently, the process modeling (government purchasing rules, in the case of sales processes; manuals from agencies like the US Food and Drug Administration, in the case of food and drug production processes, etc.). During the modeling of a process without adequate documentation, several documents, physical items needed for process execution, forms, drawings and others can take additional time for their conception (GONNET, HENNING & LEONE, 2006).
- Factor I (active or inactive state of the process): modeling often has processes that were interrupted as the object, and now they must be retaken in a more rational manner. It is more difficult to model inactive processes because the memory of those involved can be insufficient for obtaining necessary data. Furthermore, the model test will be more difficult.
- Factor J (effort needed to generate the *to be* process): Davenport (1993), Harrington, Esseling and Nimwegen (1997) and several other authors advise against *to be* modeling not preceded by *as is* analyses, since this procedure ignores executing team knowledge (OKRENT & VOKURKA, 2004). When, besides the *as is* representation of the process, project sponsors also request a *to be* perspective of the process, it is best to add extra work time, which typically varies between 50 and 80%.

4.2.2 Calculation of the Process Complexity Score

Table 2 shows the scale of values related to each factor that comprises the Process Complexity Score-PCS. These values are based on the analysis of 14 researched modeling projects.

The PCS for *as is* modeling is obtained by adding the values related to factors A to E, as applicable, by the rates inherent to factors F to I. In cases of *to be* modeling, total hours for *as is* modeling should be corrected by the J Factor, thus obtaining total hours for the two modeling processes.

For practical purposes, a scale of values was created for the PCS (Table 3) that classifies processes and sub-processes as of low, average or high complexity. This classification facilitates communication in meetings and discussions with management.

However, PCS does not consider the team's level of experience, an aspect that no doubt interferes in modeling time. Thus, an Adjustment Variable (AV) inherent to the modeling team should correct the PCS. Hence, the product of the PCS and the Adjustment Variable will give the accumulated number of modeling work hours.

The AV is a characteristic constant of the organization that empirically expresses the speed it acquires in the process modeling. The simplest way to obtain it is by defining a previously performed modeling as a standard for future ones and for calculating its PCS. In order to obtain the AV, divide the number of hours actually spent on this standard modeling by the PCS. The AV can be calculated as the average (or, better, as the mode) of relations between hours actually consumed in modeling and the PCS for each of the modeling services executed by the organization. As the organization gains experience in process modeling, its learning curve should guarantee reductions in the AV. Large organizations can calculate different AV values according to the modeled process, or according to the composition of the modeling team.

In order to facilitate data organization, it is convenient to use a spreadsheet that makes it easier for the modeler to tabulate gathered data that already contain calculation formulas embedded (cf. Table 4).

In summary:

$$PCS = (A + B + C + D + E) * (F * G * H * I) \quad (1)$$

$$AI = PCS * AV \quad (2)$$

$$TB = AI * (1 + J) \quad (3)$$

Where:

AI → modeling team hours for executing the *as is* (current status)

TB → modeling team hours for executing the *to be* (future / desired status)

4.2.3 Other cost factors
Besides the time specifically spent on process modeling, it is necessary to compute the time employed in preparatory, support and management activities. In the case of *as is* modeling, it is necessary to consider the costs of interviews, listing of activities, creation of process graphs, detailed documentation of the process, practical tests for process validation, correction of documentation, documentation release and process meetings, creation of registry documentation (spreadsheets and documents, databases and files) and creation of behavioral modeling (when necessary). For *to be* modeling, add: analysis of the process for identifying possible points for improvement, search for tasks that do not add value, or for which there will be no compensation (OKRENT & VOKURKA, 2004), interviews for testing the applicability of suggestions, raising performance indicators, creation of documentation, process saturation, documentation release meetings and documentation correction.

*4.3 Creation of the detailed WBS*
The last step of the framework is the creation of the WBS (Work Breakdown Structure). Table 5 shows an example adopted in our methodology in which the cost generator factors are computed in a single spreadsheet, making it easier to obtain total execution time for the proposed modeling. PMI (PMI, 2008) guidelines are used for guiding construction of the process.

PMI (2014) guidelines are used to direct the construction of the project. Consistent methodologies are necessary to manage their scope, quality, time and cost restrictions so that the projects are effectively managed in order to ensure their success (ALI & KIDD, 2014). Special attentions shall be paid to project portfolios risk management as the quality of this management, obtained through the increase of transparency and risk facing capacity, affects the project portfolios success (TELLER & KOCK, 2013).

The hours needed for executing the modeling for each sub-process were extracted from the spreadsheet exhibited in Table 4. The other items are inherent to execution of project management. Final modeling price will be given according to total hours *to be* employed and team hour value for each specific service.

## 5. CONCLUSIONS
The research demonstrates that by applying the proposed methodology it is possible to obtain an estimated number of resources needed for executing the process modeling. The methodology assumes the process *to be* modeled already exists. It supports itself on organization experience to increase estimate reliability. The variables that in fact cause spending of resources on modeling were identified based on systematic experience. The PCS (Process Complexity Score) provides a notion of modeling complexity and the AV (Adjustment Variable) adapts it to each organization's or each team responsible for the modeling's characteristics and competences. It is thus possible to anticipate values and resources in process modeling proposals.

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## APPENDIX

| Project Executed | Time consumption factor in process modeling | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A - number of functional roles | B - number of activities | C - number of data inputs and outputs | D - number of people who intervene in the process | E - process cycle time | F - type of modeling | G - process complexity | H - prior documentation | I - is the process active | J - *as is* and/or *to be* | K - indicators | L - event | M - resources | N - data validation |
| 1 | D | D | D | | | D | D | | | D | ND | ND | ND | ND |
| 2 | D | D | D | | | D | D | | | D | ND | ND | A | ND |
| 3 | D | D | D | | | D | D | D | | D | ND | ND | A | ND |
| 4 | D | D | D | | | D | D | D | | D | ND | ND | A | ND |
| 5 | D | D | D | | | D | D | D | D | D | ND | ND | A | ND |
| 6 | D | D | D | | D | D | D | D | D | D | ND | ND | A | ND |
| 7 | D | D | D | | D | D | D | D | D | D | ND | ND | A | ND |
| 8 | D | D | D | | D | D | D | D | D | D | ND | A | A | ND |
| 9 | D | D | D | | D | D | D | D | D | D | ND | A | A | A |
| 10 | D | D | D | D | D | D | D | D | D | D | A | A | A | A |
| 11 | D | D | D | D | D | D | D | D | D | D | A | A | A | A |
| 12 | D | D | D | D | D | D | D | D | D | D | A | A | A | A |
| 13 | D | D | D | D | D | D | D | D | D | D | A | A | A | A |
| 14 | D | D | D | D | D | D | D | D | D | D | A | A | A | A |

Legend: D — Determinant  ND- Not Determinant  A- Abandoned

**Table 1**: Factors that influence time consumption in process modeling

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| Factor | Description | Range of possible values |
|---|---|---|
| A | Number of functional roles | ≥ 1 (however, observe that in rare cases where a sub-process has more than 20 functional roles, it is probably best to divide them in two) |
| B | Number of activities | ≥ 1 (however, observe that in rare cases where a sub-process has more than 100 activities, it is probably best to divide them in two) |
| C | Number of data inputs and outputs | ≥ 1 (however, observe that in rare cases where a sub-process has more than 100 inputs and outputs, it is probably best to divide them in two) |
| D | Number of people with tasks that intervene in the process | – up to 5 people: value 1<br>– from 6 to 10 people: value 2<br>– from 11 to 20 people: value 3<br>– from 21 to 50 people: value 4<br>– more than 50 people: value 5 |
| E | Time spent on executing a typical process cycle | – 1 day: value 1<br>– from 2 to 5 days: value 2<br>– from 6 to 30 days: value 3<br>– from 30 to 100 days: value 4<br>– more than 100 days: value 5 |
| F | Type of desired modeling related to purpose for use | – Only functional: value 1.00<br>– Only Behavioral: value 1.00<br>– Both: value 1.10 |
| G | Degree of difficulty in executing the current sub-process; | If the sub-process is very complex and hard to execute, compute an additional 5% in total complexity |
| H | Pre-existence of any process documentation | If there is no documentation at all, compute an additional 5% in total complexity. |
| I | If the process is actually in use | If the process not active, compute an additional 5% in total complexity. |
| J | Effort for generating the *to be* process | If it becomes necessary to model a *to be* process, compute an additional 50% to 80% in total complexity |

**Table 2**: Scale of values for each factor in the PCS composition.

| Process or sub-process complexity | PCS |
|---|---|
| Low | 0 to 40 |
| Average | 41 to 80 |
| High | Higher than 80 |

**Table 3:** Scale of process and sub-process complexity

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**Macro process: Purchasing through Bidding Process for amounts above R25,000.00**

| | **Sub processes** | A-Functions Involved (functional roles) | | B-Quantity of Activities | | C-Quantity of data (in/out) | | D-Quantity of people | | E-Cycle Time (days) | | F-Functional or Behavioral | | G-User's perception | | H-Pre-existing document ation | | I-Process in use | | **ICP** | Type of process per complexity | | | VA – Adjustment Variable | **Hours As-Is** | J-Additional effort to generate the To Be | **Hours *as is* + To Be** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Quantity | Value | Quantity | Value | Quantity | Value | Quantity | Value | Dias | Value | Type | Value | Value | Value | yes/no | Value | yes/no | Value | | Low | Medium | High | | | | |
| 10 | Out of ERP Purchase – Sector A | **7** | 7 | **13** | 13 | **6** | 6 | **8** | 2 | **8** | 3 | **F** | 1.00 | **1.03** | 1.03 | **N** | 1.05 | **S** | 1.00 | **34** | X | | | 0.242 | 8.11 | **80%** | 14.60 |
| 20 | ERP Purchase Sector A | **8** | 8 | **15** | 15 | **8** | 8 | **6** | 2 | **10** | 3 | **F** | 1.00 | **1.03** | 1.03 | **S** | 1.00 | **N** | 1.05 | **39** | X | | | 0.242 | 9.42 | **80%** | 16.96 |
| 30 | Stock replacement | **7** | 7 | **13** | 13 | **5** | 5 | **7** | 2 | **2** | 2 | **F** | 1.00 | **1.03** | 1.03 | **S** | 1.00 | **S** | 1.00 | **30** | X | | | 0.242 | 7.23 | **80%** | 13.01 |
| 40 | Need due to contract termination | **8** | 8 | **28** | 28 | **7** | 7 | **8** | 2 | **10** | 3 | **FC** | 1.10 | **1.03** | 1.03 | **S** | 1.00 | **S** | 1.00 | **54** | | X | | 0.242 | 13.16 | **80%** | 23.69 |
| 50 | Need for Service Sector B | **7** | 7 | **23** | 23 | **12** | 12 | **7** | 2 | **15** | 3 | **C** | 1.00 | **1.03** | 1.03 | **S** | 1.00 | **S** | 1.00 | **48** | | X | | 0.242 | 11.72 | **80%** | 21.09 |
| 60 | Need for continued Service Sector B | **7** | 7 | **18** | 18 | **8** | 8 | **9** | 2 | **10** | 3 | **F** | 1.00 | **1.03** | 1.03 | **S** | 1.00 | **S** | 1.00 | **39** | X | | | 0.242 | 9.47 | **80%** | 17.05 |
| 70 | Change of Scope – Sector B | **6** | 6 | **27** | 27 | **13** | 13 | **6** | 2 | **10** | 3 | **F** | 1.00 | **1.03** | 1.03 | **S** | 1.00 | **S** | 1.00 | **53** | | X | | 0.242 | 12.71 | **80%** | 22.88 |
| 80 | Bidding Process – Sector A | **13** | 13 | **59** | 59 | **28** | 28 | **20** | 3 | **45** | 4 | **FC** | 1.10 | **1.05** | 1.05 | **S** | 1.00 | **S** | 1.00 | **124** | | | X | 0.242 | 29.91 | **80%** | 53.83 |
| 90 | Letter of Invitation for Bidding – Sector A | **12** | 12 | **63** | 63 | **28** | 28 | **20** | 3 | **45** | 4 | **F** | 1.00 | **1.05** | 1.05 | **S** | 1.00 | **S** | 1.00 | **116** | | | X | 0.242 | 27.95 | **80%** | 50.31 |
| 100 | Bidding Process – Sector B | **9** | 9 | **58** | 58 | **28** | 28 | **15** | 3 | **45** | 4 | **F** | 1.00 | **1.05** | 1.05 | **S** | 1.00 | **S** | 1.00 | **107** | | | X | 0.242 | 25.92 | **80%** | 46.65 |
| 110 | Letter of Invitation for Bidding – Sector B | **7** | 7 | **41** | 41 | **20** | 20 | **10** | 2 | **45** | 4 | **F** | 1.00 | **1.05** | 1.05 | **S** | 1.00 | **S** | 1.00 | **78** | | X | | 0.242 | 18.80 | **80%** | 33.85 |
| 115 | Judgement of appeal | **4** | 4 | **6** | 6 | **4** | 4 | **6** | 2 | **5** | 2 | **F** | 1.00 | **1.00** | 1.00 | **N** | 1.05 | **S** | 1.00 | **19** | X | | | 0.242 | 4.57 | **80%** | 8.23 |
| 120 | Contract Sector A | **9** | 9 | **31** | 31 | **9** | 9 | **15** | 3 | **15** | 3 | **F** | 1.00 | **1.03** | 1.03 | **N** | 1.05 | **S** | 1.00 | **59** | | X | | 0.242 | 14.39 | **80%** | 25.91 |
| 130 | Contract Sector B | **6** | 6 | **16** | 16 | **6** | 6 | **8** | 2 | **15** | 3 | **F** | 1.00 | **1.03** | 1.03 | **N** | 1.05 | **S** | 1.00 | **36** | X | | | 0.242 | 8.64 | **80%** | 15.55 |
| | | | | | | | | | | | | | | | | | | | | **Totals** | **6** | **5** | **3** | | **202.01** | | **363.62** |

**Table 4:** Spreadsheet with general data for a process *to be* modeled

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| Quantity | Description | Team | Base Hours | Adjusted Hours | Unit | Subtotal |
|---|---|---|---|---|---|---|
| | | | | | | |
| | Project Planning | | | | | |
| | Scope | | | | | |
| 1 | Company Vision | P | 2 | 2 | $ 220.00 | $ 440.00 |
| 1 | Business problem | P | 6 | 6 | $ 220.00 | $ 1,320.00 |
| 1 | Human Resources – Definition of Responsibilities | P | 2 | 2 | $ 220.00 | $ 440.00 |
| 1 | Acceptance Criteria | P | 2 | 2 | $ 220.00 | $ 440.00 |
| 1 | Deadlines | P | 2 | 2 | $ 220.00 | $ 440.00 |
| 1 | Communication Plan | P | 2 | 2 | $ 220.00 | $ 440.00 |
| 1 | Risks | P | 2 | 2 | $ 220.00 | $ 440.00 |
| 1 | Infrastructure solution for team works | P | 4 | 4 | $ 220.00 | $ 880.00 |
| 1 | Presentation of the methodology *to be* used | P | 2 | 2 | $ 220.00 | $ 440.00 |
| | Processes modeling | | | | | $ - |
| 1 | SubProcess X-10 | M | 53 | 53 | $ 280.00 | $ 14,840.00 |
| 1 | SubProcess X-20 | M | 44 | 44 | $ 280.00 | $ 12,320.00 |
| 1 | SubProcess X-30 | M | 67 | 67 | $ 280.00 | $ 18,760.00 |
| | .... | | ... | | | |
| 1 | SubProcess X-n | M | 36 | 36 | $ 280.00 | $ 10,080.00 |
| 1 | Documents for release by the contracting company based on previously defined documents | P | 2 | 2 | $ 220.00 | $ 440.00 |
| 4 | Review of processes by Senior Specialist | S | 2 | 8 | $ 120.00 | $ 960.00 |
| 1 | Project Executive Summary | P | 4 | 4 | $ 220.00 | $ 880.00 |
| 4 | Preparation of executive summary presentation of each sub process | M | 1 | 4 | $ 280.00 | $ 1,120.00 |
| 4 | Presenting final solution to users | P | 4 | 16 | $ 220.00 | $ 3,520.00 |
| 1 | Meeting to receive authorization for services release based on previously presented documents | M | 2 | 2 | $ 280.00 | $ 560.00 |
| 5% | Project management | P | | 9.4 | $ 220.00 | $ 2,068.00 |
| | | | **Total:** | **269.4** | | **$ 70,828.00** |

| |
|---|
| **Key for type of team** |
| **P**: Project team - composed of the project manager and one process leader. |
| **M**: Team of modelers – composed of one interviewer and surveyor, one person to take notes and observations, and one person to document the results in modeling and documentation software. |
| **S**: Senior Process Analyst |

**Table 5**: Complete proposal for executing process modeling services.