

A Procedural Approach for Evaluating the Performance of Business Processes

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Abstract: BPM is a systematic approach that enables an organization to achieve results that are consistent and aligned with its strategic objectives. In this context, organizations need to measure the performance of their processes, thereby enabling them to support planning, inducing control and making it possible to diagnose the current situation. The research that led to this article was prompted by the paucity of empirical investigations into performance measures offered in the literature and recognition of the difficulties that organizations face when attempting to verify the results of their business processes. From a systematic review of the literature, it became evident that, among the approaches discussed, there are several variations in the methodology, in the specifications of the measures and even as to how business processes are evaluated. By undertaking a comparative evaluation of the approaches, a set of criteria was defined which addresses not only theory, based on the references, but also some usability aspects of a process performance model. Thus, we proposed the definition of a new approach that brings together elements and recommendations selected from the approaches analyzed, plus enhancements. To evaluate the proposed approach, a case study is discussed, and important results presented which demonstrate its applicability.

1 INTRODUCTION

Various organizations have been engaging on reorganizing their business processes and implementing process-based management in order to gain competitive advantage. From this perspective, the concept of Business Process Management (BPM) has emerged as a management approach that shifts the focus from functional units to controlling the performance of business processes in achieving their objectives.

BPM enables corporate processes to be standardized, thereby increasing the productivity and efficiency of the organization. Its aim is both to monitor, after having defined the priorities of the processes, how the resources of an organization are applied and transformed into actions to achieve the organizational goals (Baldam et al., 2007). The results of the processes are directly linked to the mission and goals of the organization, since the processes represent the implementation of the strategy.

The focus of process management is supported on key business strategies that establish the direction of the organization. Smith and Furt (2009) emphasize

that a critical factor is the need for measurement in process management. Therefore, it becomes essential to use measures that enable the performance of processes to be monitored, thus contributing to check how well these processes meet the strategic objectives that have been set.

Trkman (2010) states that issues related to performance measures and to defining what should be measured in relation to business processes should be directly linked to the strategic priorities of each organization.

BPM initiatives need to be evaluated to check the alignment between the strategic, tactical and operational aspects of processes, thus making it possible to verify the results achieved in accordance with the objectives outlined. Business processes should be designed by the administration, after having established measures of performance (Powell et al., 2001), which should reflect the desired direction in strategic objectives, and serve as a basis for the control of processes.

According to Kueng and Krahn (1999), as well as Vuksic et al. (2008), the effects of BPM programs are often not easily visible as to the generation of value when organizations are unaware of or do not have good control over the operation of its processes. The

result of this is to create performance indicators that reflect departments' prompt results, defined by a functional management focused on a vertical view (Pidun and Felden, 2012). Thus, measures and evaluation of performance end up targeting the functional performance of departments and individuals when they should focus on the outcomes of the process.

According to Leclair et al. (2012), organizations have difficulty in defining what should be measured, and end up measuring less complicated aspects such as productivity, cost, time; and often neglecting indicators linked to strategy. Based on their analysis of empirical studies, Pidun and Felden (2012) verified there is a gap between the analysis, implementation and execution of processes as well as between strategic management and operational execution; to which they give as a possible explanation the lack of a methodological orientation of systems that measure the performance of Business Processes.

In the analysis of Pidun et al., (2011), various models for assessing the performance of Business Processes use numerical parameters, and artificial and simplifying measures in an attempt to assess processes. However, various processes of a qualitative and non-deterministic nature end up not being evaluated effectively. If various processes are not evaluated or this evaluation is difficult when using these measures, possible problems or performance results may remain invisible to managers, and thus make hardly any contribution to the decision-making process and consolidate the gap between strategy and business processes (Pidun and Felden, 2012). This leads us to following research question: *Which approach best meets the evaluation of business processes, with a view to a greater alignment between process indicators and strategic objectives?*

Based on the model proposed by Wohlim (2000), which was adapted from the GQM (Goal Question Metric) method, the overall objective of this research is: (1) To analyze metric models or approaches for assessing business processes proposed in the literature; (2) Proposing an assessment approach to business processes that contribute to a better alignment between indicators of processes and strategic objectives; (3) Checking applicability from the standpoint of leaders, analysts and owners of the process; (4) In the Business process of a public organization context.

The rest of the article discusses theoretical and methodological reference works in Section 2. Then, the Approach put forward in this paper is described (Section 3). Section 4 presents the results obtained by

applying the Approach and in Section 5 final remarks are made, the contributions of the paper listed and suggestions for future studies made.

2 THEORETICAL AND METHODOLOGICAL REFERENCES

The research began with an ad hoc review of the literature in order to search for and acquire, in general, a better understanding of how the performance of business processes is evaluated. This review contributed to defining the research problem and subsequently to formulating the objectives of this paper.

After this stage, it was found there was a need to conduct a systematic review of the literature (SRL). This method enables a wider range of relevant results to be included, instead of the limitation on our conclusions that would result from reading only a few articles. The bibliographical search was conducted in accordance with the systematic review of literature method defined by Kitchenham (2004).

With the objective of analyzing, more specifically, what the measures or indicators of they are and how they are being used measures or indicators of performance are and how they are being used in the context of managing business processes to ensure that processes and strategic objectives are aligned. The following search questions for the SRL were defined:

- QP1- What are the metrics and indicators that are being used in the evaluation of business processes?
- QP2- Do the studies have rules, guidelines or sets of guidance on how to use the metrics presented?
- QP3- What is the context in which the metrics are being used?

Automatic searches were conducted in the digital libraries of the Association for Computing Machinery (ACM), the IEEE Computer Society, Emerald Insight, Science Direct and Springer Link. The result of the searches resulted in the return of 3,377 articles. Their titles and/or abstracts of these were analyzed, and exclusion criteria were applied. References were discarded that clearly dealt with other matters not relevant to the purpose of this research, as a result of which an initial selection of 25 items was made. The second filter consisted of reading the text of the articles initially selected in their entirety and as a result the list of articles described in Table 1 were obtained.

It was found from the analysis of the approaches selected (Section 3), there was a need to propose a systematic approach (Section 4), which would combine relevant and complementary aspects of the articles analyzed.

Table 1: Final result of selecting the studies.

ID	Title of Article
EP6	Optimizing Process Performance Visibility through Additional Descriptive Features in Performance Measurement.
EP7	Organizational Performance Measures for Business Process Management: A Performance Measurement Guideline.
EP9	Research on Key Performance Indicator (KPI) of Business Process.
EP11	The Research of Metrics Repository for Business Process Metrics.
EP13	Two Cases on How to Improve the Visibility of Business Process Performance.
EP15	Performance measurement in business process outsourcing decisions: Insights from four case studies.
EP22	Quality evaluation framework (QEF): Modelling and evaluating quality of business processes.

In order to verify the usefulness of the proposed approach, a case study was conducted of a business process of a public organization. In particular, this is an empirical research that according to Yin (2005) that investigates a current phenomenon within its real context, when the boundaries between the phenomenon and context are not clearly defined. The case study is described in Section 5 of this article.

The different approaches discussed above show variations in the methodology, specifications and even as to how business processes are evaluated. In order to assess these approaches, a set of criteria was defined which addresses both the theory, based on the selected references, and some aspects of usability. The criteria used were:

- Methodology: Ad-hoc (Ah) OR Systematic (Sy);
- Types of measures: Quantitative (Qt) AND/OR Qualitative (Ql);
- Context of Applications: Specific (S) OR Generic (G);
- Processes supported by systems: Yes OR No;
- Efficiency: Yes OR No;
- Effectiveness: Yes OR No;
- Empirical validation: Yes OR No.

The criterion of Methodology is related to the attention to the way in which an approach can be used

to evaluate a business process. Classified approaches such as systematic ones are those that describe a set of rules, guidelines, processes or activities needed to use the measures presented. On the other hand, ad-hoc approaches focus only on describing performance measures, without, at first being interested in the way that its approaches can be put into practice.

The criterion named types of measures concerns the nature of the measures presented in the selected approaches. Quantitative measurements are those based on numerical performance indicators, while qualitative measures consist of textual descriptions and narratives about factors of success of the process and which often require interpretation.

The criterion called application is related to the context in which a particular approach can be used. Certain approaches present measures that are sufficiently generic so that they that can be applied in different contexts and business processes of very different natures. Approaches classified as specific are those used in a specific business process or those of a similar nature.

Some approaches have performance measures that are established from information generated by business process automation systems. In other words, the use of the measures presented is associated with making information available by means of systems. The criterion of processes supported by systems is related to the concern for analyzing if the performance evaluation of the process depends, in principle, on some support by means of systems such as a BPMS (Business Process Management Suite), for example.

The aim of using criteria of efficiency and effectiveness is to describe whether the approaches analyzed present measures to evaluate the productivity and performance (efficiency) of processes, as well as their ability to do what is needed, which is correct in order to reach a certain goal or outcome (effectiveness). Efficiency involves the way in which an activity or process is performed; effectiveness refers to whether it results in meeting customer's needs in all their restrictions. According to Corrêa and Corrêa (2006), efficiency is a measure of the extent to which an organization's resources are used economically, and effectiveness refers to the extent to which the objectives are achieved.

The criterion of empirical validation is concerned with assessing the practical utility of the proposed measures in the different approaches. Empirical validation occurs by conducting experiments, case studies or research in a real context, and helps to determine the effectiveness of these measures.

Tables 2 and 3 present the approaches investigated related to the evaluation criteria illustrated above

Table 2: Evaluation Criteria (Methodology, Measures and Application).

Articles	Evaluation Criteria					
	Methodology		Measures		Application	
	Ah	Sy	Qt	Ql	S	G
EP6	X		X	X		X
EP7		X	X			X
EP9	X		X		X	
EP11	X		X			X
EP13	X		X	X		X
EP15	X		X		X	
EP22		X	X			X

Table 3: Evaluation Criteria (System support, Efficiency, Effectiveness and Empirical validation).

Studies	Systems	Efficiency	Effectiveness	Validated
EP6	No	Yes	Yes	No
EP7	No	Yes	Yes	No
EP9	Yes	Yes	Yes	No
EP11	Yes	Yes	No	No
EP13	No	Yes	Yes	Yes
EP15	No	Yes	Yes	Yes
EP22	No	Yes	No	Yes

Based on the criteria presented and discussed earlier in this paper, we considered that a systematic approach (which enables the metrics presented to be used consistently), which brings together quantitative and qualitative performance measures, generically (measures not linked to a specific context or domain) not dependent on using systems that provide an evaluation of efficiency (resources) and effectiveness (results) and which had been validated empirically could be considered ideal, or one that best meets the evaluation of performance of business processes.

From the analysis of the selected approaches, there was a need to propose a systematic approach that would combine relevant and complementary aspects of the studies analyzed.

3 APPROACH PROPOSED FOR EVALUATING THE PERFORMANCE OF BUSINESS PROCESSES

Of the approaches investigated, the one that comprises the largest number of requirements, set out

in the previous section, is Article EP13. However, it does not describe in great detail how this approach can be used. Moreover, the approaches presented in articles EP7 and EP22 do give a detailed description of the process for using performance measures.

In article EP7, Vuksic et al. (2008) argue that the performance measures of a process should be aligned to the strategic goals and objectives of the organization and that they should be measured under the quantitative and qualitative dimensions, Nevertheless, the metrics presented in the article are quantitative, whereas, in Article EP22, the performance measures are associated exclusively with expressions quantified as a quality objective.

It was arising from these considerations that our approach was defined. It brings together the model of performance measures described in EP13, but using it as a guide to using the measures presented, and the procedural description defined in Article EP7.

3.1 Process for Evaluating the Performance of Processes

The evaluation process defined in EP7 is illustrated in Figure 1 below:

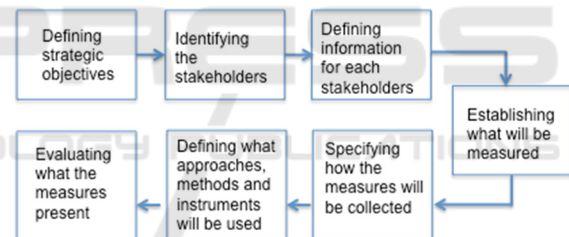


Figure 1: Process for using performance measures.

The aim of the activities illustrated in the process flow is to lead to proposing a guideline for measuring the performance of business processes. In order to provide adequate guidance for assessing performance, on following this procedural description, a description will be given below of the steps and some artifacts or suggestions that may contribute to making such an assessment.

3.1.1 Defining the Strategic Objectives

According to Vuksic et al. (2008), the performance measures of business processes should be aligned to the organizational goals and objectives. The first activity in the process of evaluating the performance of a process consists of defining the strategic objectives to be achieved by the results of the processes. These objectives are defined by the owners

of the process in the organization, and can be obtained from the strategic planning documents.

3.1.2 Identifying the Stakeholders

After the identifying the objectives of the process, the stakeholders in the conduct of the process must be identified, i.e., those responsible for the process, those taking part in the activities, clients, beneficiaries, sponsors and others. Process mapping artifacts or even the use of a RACI matrix can contribute to defining the stakeholders in implementation.

3.1.3 Defining the Information Required for Each Party

The information needs of each stakeholder can be very different, and require that the performance measures be adapted to their requirements.

The activity of mapping makes it possible to define the roles and responsibilities of each participant during the implementation of the process more clearly and objectively thereby contributing to defining the information required for each party and assisting in defining the performance measures.

3.1.4 Establishing what Will be Measured

In this stage what is sought is to identify what measures are useful for evaluating the performance of the process in relation to its goals, in achieving the strategic objectives. Performance reports or accounting documents can be used to identify performance measures of the process.

3.1.5 Specifying how the Measures Will be Collected

When identifying the performance measures of a process, a process for collecting these measures needs to be identified. In the case of processes supported by systems, there automated data collection. In order to develop an action plan for identifying and collecting performance measures in non-automated processes, an adaptation of the 5W2H management tool was proposed as an artifact for this step. The information is organized as follows:

- Description of the measure (What): Defines what this measure means.
- Rationale (Why): Defines the end, the purpose of using the measure.
- Instruments to obtain measures (From where): Specifies the instruments (media) from where

the data of the measures can be collected.

- Frequency (When): Determines the frequency or time interval at which the information of the measures needs to be collected.
- Responsible (Who): Describes the sector or department responsible for providing information on a particular measure.
- Process for obtaining measures (How): Details what process will be undertaken to obtain the measures.
- Costs (How much): Describes the costs for obtaining the measure.

3.1.6 Defining what Approaches, Methods or Instruments Will be used

There are several approaches and frameworks that use different methods for measuring performance, described in the literature, as well as various tools that support these evaluation methods.

Based on the critical analysis of the approaches presented in Section 3, it was found that the model in EP13 has the largest number the criteria presented. Thus, it is recommended that this is used in step for evaluating the process. Subsection 4.2 presents how the measures in the EP13 model are systematized.

3.1.7 Assessing what the Measures Present

The performance measures of business processes should be related to (or the same) measures existing in the organization that are used to monitor the success of the strategy.

3.2 Adapting the Evaluation Model

The performance measures defined in Article EP13 require a greater capacity of interpretation due to the way they are presented. The paper presents the measurements in the form of questions such as: There numerical parameters linked to quality, such as cycle time, probability of failure or average of interruptions. This could hamper their use by individuals who evaluate their business processes.

Given this configuration, the measures model was systematized in an attempt to make it orderly, coherent, clear and understandable by the parties that may use it. The model originally defined in EP13 was discussed together with two BPM experts until the model shown in Tables 4 and 5 was reached.

Table 4: Systematization of the Measures Model (Efficiency).

		Efficiency	
		Indicators	Types of Indicators
NP (*)	Key Performance Indicator (KPI)		- Time cycle of the process; - Countable amounts of process outputs; - Number of returned processes; - Number of processes carried out; - Downtime; - Percentage of the budget used.
		Indicators	Types of Indicators
DP (**)	Process Success Factors (PSF)		- Benefits, scope and steps of the process; - Information systems, databases or interfaces used; - Description of the success of the process; - Documents and information produced and delivered.

(*) Numeric Parameters; (**) Descriptive Parameters.

Table 5: Systematization of the Measures Model (Effectiveness).

		Effectiveness	
		Indicators	Types of Indicators
NP (*)	Metrics of the Process (PMX)		- Probability of failure; - Average number of interruptions; - Time-cycle approval meetings; - Number of approval meetings; - Number of approvers / officers-in-charge.
		Indicators	Types of Indicators
DP (**)	Description of the Components which comprise the Process (PO)		- Departments responsible, informed or affected; - Role of approvers or officers-in-charge; - Interfaces with other departments; - Conditions and restrictions; - Initiators, beneficiaries and customers of the process; - Key people or information system for a step of the process or shared backup.

(*) Numeric Parameters; (**) Descriptive Parameters.

Also added to the model described above was an auxiliary table, which describes in detail each of the indicators presented. Such as, for example, “Process Cycle time: corresponds to the time required for performing the process, i.e. the time between the start and end of the process”.

The proposed approach to evaluating business process performance of this work consists of the process for measuring performance, artifacts and

model of systematic measures described in this section. In order to ensure the validation of the approach, it was applied in a real business process of an organization, and this is described in the next section.

4 RESULTS AND DISCUSSION

The process that was selected to validate the proposed approach is called Pro-equipment, linked to the Pro-rectorate for research and postgraduate subjects (PROPESQ) of a Brazilian Federal Institution of Higher Education (IFES).

Pro-equipment procures equipment intended for shared use in the structure of scientific and technological research of post-graduate programs of the recommended IFESs and is funded by the Coordination Unit for Improving the Qualifications and Experience of Higher Education Personnel (CAPES), and is linked to the strategic objective of stimulating the development of research. The selection of this process, to validate the proposed approach, occurred in a timely manner in view of the demand for having it mapped and optimized, requested through PROPESQ together with the IFES Office for Processes to which the author of this research is linked.

4.1 Defining the Objectives of the Process

The first interview was attended by two representatives of the Research Board (DPQ in Portuguese) and three process analysts of the Processes Unit of the institution were also present. The two participants are directly responsible for the performance of the process.

Initially a description of the following points was requested:

P1 – “What is the Objective of Mapping and Optimizing the Process?”

According to Respondent 2, the main problem of this process is the lack of transparency of the information on the results, when he states that:

E2 - "We have partial and not effective control, for example, we know the input volume of resources, we know how much CAPES makes available, and we even know how much of the resources were earmarked because the Accounts Department of PROPESQ send us this information on a spreadsheet, if we request it. From there on, we have no feedback, we do not know if the teacher received it. "

P2- *“What is the Objective of the Pro-Equipment Process?”*

E1 - *“To stimulate scientific production by acquiring equipment intended for shared use in postgraduate laboratories of the university.”*

4.2 Identifying Stakeholders in the Process

P5 – *“Who are the Stakeholders in the Process?”* Specifically those in charge (the owners of the process), participants of the activities (sectors), clients, beneficiaries and sponsors.

CAPES acts as the sponsor, the clients of this process were defined as the teachers and/or research groups. Finally, the participants in the activities when the given process was being carried out were: the Director of Research (DPQ/PROPESQ), the Accounting Board (DC/PROPESQ), the Agreements Sector (PROPLAN), the Legal Department (Office of the Rector), the Rector, The National Purchases Sector (PROGEST), the Importations Sector (PROGEST) and the Publishing Sector (PROGEST).

4.3 Defining the Information Necessary for Each Party

At this stage we were invited to the meetings, prior to which the stakeholders described above, excluding the sponsor of the process (CAPES). This was justified by the fact that CAPES is configured as an entity external to the University context in which one does not have dominion over the rules and procedures used.

Four meetings were held with the following representatives: 02 (DPQ/PROPESQ), 01 (DC/PROPESQ), 01 (Agreements Sector/PROPLAN) and 01 (PROGEST). At this stage the process was modelled collaboratively using the BizAgi Process Modeler.

The process starts from the release of the official notice by CAPES. Then, the Board of Research (DPQ) sets an internal schedule of activities before submitting a single proposal.

Generally, the amount of resource requested by the projects is greater than the amount initially made available by CAPES. Therefore, the DPQ convenes a committee to assess and recommend what projects should be submitted. The end result of the projects selected internally is announced and submitted to the CAPES.

These projects will be further evaluated by CAPES, who may refuse some requests. Projects approved at this stage are announced by DPQ. After this step, the term of decentralization of credit is sent to PROPLAN, the process is reviewed, and the

document is sent to the Legal Department, which will analyze items such as dates, terms, rubrics, data, etc. The Legal Department must give its assent in writing to ensure the process continues. If so, the process is sent for the signature of the Rector of the institution. The process for requesting ear-marking is then returned to PROPLAN which monitors that CAPES has released the funds and PROPLAN notifies the Accounting Sector of PROPESQ.

The Accounting Sector of PROPESQ then starts the activity of mounting the ear-marking process for each piece of equipment. At this moment, a request is made to the coordinators of the subprojects for a series of documents. Subsequently, the accounting entry for the committed funds is made via PROGEST, and there follows a new phase of analysis by the Legal Department. After being approved by the Legal Department, the process goes to the Publishing Sector in PROGEST, and the flow of the process proceeds to the National Purchases or Importations Sector so that the purchase can be made.

4.4 Defining what Will be Evaluated in the Process

At this stage there were two interviews with those responsible (DPQ) for this process. Initially the interviewee was asked about the existence of an accounting report on the performance of the process.

According to E1 - *“CAPES demands an indication of how the previous buying process was conducted. We describe, when asked, only what was actually ear-marked .”*

For interviewee E2, this kind of report is based on measures that do not reflect, in a satisfactory manner, that achieving the objectives of the process was verified.

E2 - *“Ear-marking is only the first stage of the expenditure budget, where the funds were granted, but there is no guarantee the equipment will be purchased.”*

When asked: *“What are the important performance measures for making a satisfactory assessment of the results of this process?”*

E1 - *“In my opinion we should have information about whether or not the equipment was purchased, was actually installed in the laboratory and which research groups are using it”*.

Still on the measures that should be used to evaluate the process, interviewee E2 stated that:

E2 - *“Besides the amount ear-marked and bits and pieces to be paid, which are data that we can get easily, we need to know the quantity and description of the pieces of equipment bought, how many and which ones are awaiting delivery and installation, and what the institutional outcomes are (number of dissertations,*

theses, descriptive reports on patents generated or information on the rendering of research services to other institutions) that have been achieved".

4.5 Specifying how the Measures Will be Collected

At this stage a meeting was held with the same representatives who took part in the mapping of the process meetings. Initially, a projection of the mapping process was presented, followed by a set of measures that were extracted. The measures presented to the participants were:

- Total amount ear-marked;
- Amount spent the ear-marked resources;
- Amount in smaller bills to be paid;
- List of equipment purchased;
- List of delivered equipment;
- List of installed equipment and;
- Academic indicators.

For each of the measures proposed the artifact for specifying the collection process defined in the approach was discussed jointly by the participants and filled in. Table 6 shows an example.

Table 6: Collection process for academic indicators.

Academic Indicators	
Description measure	Corresponds to descriptive reports on data from the scientific production supported by the equipment purchased. Reports may contain descriptive information about numbers of dissertations, theses, patents obtained as a result of using the equipment, as well as descriptions of services rendered to other institutions.
Justification	One of the strategic objectives of PROPESQ is to encourage scientific production of the university. Products purchased by Pro-equipment are intended to contribute to achieve this goal. Academic indicators enable the results of this process to be made more visible in relation to achieving the strategic objectives.
Instruments to obtain measures	Scientific production reports from research laboratories that have equipment coming from Pro-equipment funds.
Periodicity	<i>Ad hoc.</i>
Officer-in-charge	Coordinators of postgraduate laboratories.
Process for obtaining measures	Meetings or requests via email.
Costs	Time

4.6 Applying Performance Assessment Model

At this stage, four meetings were held with the members already described: (02) representatives of DPQ /PROPESQ, (01) representative of the Accounting Sector/PROPESQ, (01) representative of the National Purchases Sector and the Importations Sector of PROGEST. Meetings were held separately. The procedure for conducting this step may be described in three phases:

- Presentation of the Model – in this stage the presentation was made, using a print document format, of the model of measures defined to the interviewee.
- Recording of the participants' responses – the interviewees' answers were recorded in the document.
- Summary of the responses – in this stage, the responses were combined in a single table, thereby eliminating redundancies and inconsistencies in a single frame.

Table 7 presents some of the indicators obtained in this step:

Table 7: Systematization of the Measures Model (Efficiency).

Efficiency		
	Indicators	Types of Indicators
NP (*)	Key Performance Indicator (KPI)	- Amount raised from CAPES; - Amount of funds spent; ear-marked (Percentage used of the budget)
DP (**)	Indicators	Types of Indicators
	Process Success Factors (PSF)	- Steps: Official notice published, term of decentralization of credit unundertaken, Review and analysis of the process, Release of Credit Authorized, Constructing ear-marked funds, review and analysis of the funds ear-marked followed by legal approval, Publication in the Official Gazette of the Union, Purchase and control of acquisitions made; - Information systems, databases or interfaces used: SICAPES (the CAPES Integrated System), net purchases (Purchases Portal of the Federal Government), SICAF (System for the Unified Registration of Suppliers);

(*) Numeric Parameters; (**) Descriptive Parameters.

4.7 What the Measures Present

A set of measures for the process as a whole, and its "partitions" (steps, departments, stages, etc.) have been defined in the previous section so as to reflect certain performance characteristics for each management level of stakeholder. These measures describe by means of generating information the actual state of the configuration of the process, thus enabling aspects of performance to be evaluated such as complexity in operations, bottlenecks, redundant activities, excessive documentation and approvals. In addition, they make it possible to evaluate the results of the process as to achieving the objectives set.

Regarding Pro-equipment, a check was made on the opportunity to insert some improvements into the process. The following optimization proposals were discussed, as a result:

- Integrating the Superintendence of Works (SPO in Portuguese) in the early stages of the process, specifically in the (internal) evaluation stage of the sub-projects to be submitted to CAPES. The function of the SPO is to carry out assessment in order to identify if the laboratory to which the equipment will go, has the infrastructure needed for its installation. In several situations it was reported that the purchase of equipment had been made but the research lab did not have an infrastructure appropriate for its installation. Currently, the process for guaranteeing resources for renovations, or purchase of equipment to ensure the effective installation of the equipment is only started from the moment that the equipment is delivered to the university.
- The urgency to get the guarantee of these funds for the purchase of equipment by ear-marking funds encouraged the actors of the department responsible not to check the (full) requirements of documentation defined by legislation for the formation of these processes (ear-markings). The process very often did not follow its "normal" flow, where and if it was published in the Official Gazette of the Union without necessarily obtaining the approval of the Legal Department. This deviation in the flow led, in various situations, to delays in conducting the process due to non-observance of the applicable legislation.
- The information on the results obtained for the research based on acquiring equipment were practically non-existent or difficult to monitor. As a proposed solution which was discussed between the actors of the process is the creation of the role of research lab coordinator.

At first, the adoption of the model, which combined quantitative performance measures (that permit performance to be measured and managed) and qualitative measures (which allow grounding of the critical analysis of the results), manages to gather important information about the performance of the process in relation to the strategic goals and objectives set, in accordance with the evaluation of utility perceived by the participants in the process.

5 CONCLUSIONS

In relation to the overall objective of the research, which consisted of verifying which approach best serves the evaluation of business processes, with a view to greater alignment between process indicators and strategic objectives, it may be noted that there is no single approach that adequately assesses the performance of business processes.

Several variables can be measured and evaluated with regard to business processes. However, it falls to managers to undertake the tasks of identifying, selecting and defining measures that are adequate for and aligned with the organization's objectives. The model used has a large number of indicators that can and should be adapted to different organizational contexts, from which the most important for use in practice should be selected. Finally, it is essential that an organization uses several indicators when evaluating its business processes, since the use of a single indicator can not represent the broader context needed to support effective decision making.

Note that in the analysis of the literature and in the very conduct of the empirical study, there was evidence of the need to evaluate the performance of business processes based on quantitative and qualitative measures. Managers must consider the various existing measures for evaluating business processes and should spare no effort in identifying, selecting and defining the most important one for use in practice.

In order to complement the results found in this research, we propose the use of the approach in several different business processes, with a view to verifying its real results for the different characteristics of operations and dynamics of an organization such as: culture, size, area of activity, and so one.

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